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**When your native language
sounds foreign:
A phonetic investigation into
first language attrition**

Esther de Leeuw

A thesis submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy
in Speech and Hearing Sciences

Queen Margaret University, Edinburgh.

May 2009

Declaration

I confirm that the thesis submitted is my own work and that appropriate credit has been given where reference has been made to the work of others.

Esther de Leeuw, 27 May 2009

Publications from the thesis

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Abstract

The research presented in this thesis comprises two experiments which investigated whether the domain of phonetics can undergo first language attrition, or be lost, when a second language is acquired in adulthood in a migrant context.

Experiment I investigated the native speech of 57 German migrants to Anglophone Canada and the Dutch Netherlands. The bilingual migrants had grown up in a monolingual German environment and moved abroad in adolescence or adulthood. Their semi-spontaneous German speech was globally assessed for foreign accent by native German speakers in Germany. It was revealed that 14 bilingual migrants were perceived to be non-native speakers of German. Age of arrival to Canada or the Netherlands and contact with one's native language played the most significant roles in determining whether the German speech of the migrants was assessed to be foreign accented. Crucially, it was not only the amount of contact, but also the type of contact which influenced foreign accented native speech. Monolingual settings, in which little language mixing was assumed to occur, were most conducive to maintaining non-foreign accented native German speech.

These findings prompted Experiment II, in which the speech of 10 German migrants to Anglophone Canada was examined in fine phonetic detail. The participants in this experiment had similarly grown up in a German speaking environment and migrated to Canada in late adolescence or adulthood. Segmental and prosodic elements of speech, which generally differ between German and English, were selected for acoustic analyses. Given that each phonetic element was measured according to two dimensions, it was possible to determine that in the lateral phoneme /l/, the frequency of F1 was more likely to evidence first language attrition than the frequency of F2; and that in the prenuclear rise, the alignment of the start of the rise was more likely to display first language attrition than the alignment of the end. In addition to intrapersonal variation within the same phonetic variable, interpersonal variation was observed. Two participants evidenced no first language attrition, whilst one participant realised both dimensions of the lateral phoneme /l/ and prenuclear tonal alignment according to the English monolingual norm in his German. When extralinguistic variables were investigated, age of arrival (and neither amount nor type of language contact) had a significant impact on determining first language attrition, although this effect was only observed in the alignment of the prenuclear rise.

While the experiments revealed stability in the native speech of late consecutive bilingual migrants, first language attrition in the domain of phonetics was observed at both the level of perception and performance. Taken together, these findings challenge the traditional concept of native speech by revealing that indeed native speakers diverge from the norms of native (monolingual) speech.

To Willy, Nathan and Samira Winahasi Lee

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Nomenclature

$A_{EnglishC}$ Amount of contact with English in category

$A_{EnglishNormalisedC}$ Normalised amount of contact with English in category

$A_{EnglishNormalised}$ Normalised amount of contact with English averaged over all categories

$A_{GermanC}$ Amount of contact with German in category

$A_{GermanNormalisedC}$ Normalised amount of contact with German in category

$A_{GermanNormalised}$ Normalised amount of contact with German averaged over all categories

MAX_{abC1} Absolute difference between MAX and C1 in ms

MAX_{rel} Relative difference between MAX and C0 in %

MIN_{abC0} Absolute difference between MIN and C0 in ms

MIN_{abV0} Absolute difference between MIN and V0 in ms

MIN_{rel} Relative difference between MIN and C0 in %

AOA Age of arrival

F0 Fundamental frequency

F1 First formant

F2 Second formant

FAR Foreign accent rating

fMRI Functional magnetic resonance imaging

Hz Hertz

L1 First language

L2	Second language
LOR	Length of residence
ms	milliseconds
ST	Semitone
Stdev	Standard deviation
VOT	Voice onset time

Chapter 1

Introduction to the thesis

Moving to a new country often involves exposing oneself to a new language as well as a new culture. A consequence of increased contact to a new language community may result in a decrease in contact with the culture and language of one's country of origin. Such is the situation for many people who acquire not only a new country of residence, but also a new language.

In the past, interest has focused on the acquisition of the new, or second, language (L2) in migrant populations.¹ Only recently have researchers begun to investigate the language of origin, or first language (L1), in migrant communities. Research conducted in this latter light aims to describe that which occurs within an individual's L1 when he or she emigrates from its source, as well as to explain why such changes occur.

Studies into first language attrition set about answering these questions. As the term implies, investigating the attrition of an individual's L1 focuses on 'loss'. Specifically, such studies explore which aspects of an individual's native language have been lost in a migrant setting and why loss has occurred.² More fundamentally, they address the question of whether a native language can actually ever be 'lost'.

During the short history of research into first language attrition, linguistic domains such as the syntax, lexis and morphology have been the focus. The pronunciation of a migrant's L1 has received less attention. It is the purpose of the present thesis to bridge this gap by exploring phonetic aspects of first language attrition. In doing so, the investigation

¹I have chosen the word 'migrant' to refer to individuals who move from one country to another. Other studies, investigating similar people, may use terms like 'immigrant', 'emigrant', 'émigré' or 'expatriate'. In my opinion, the term I have chosen is the most neutral of these and it is for this reason that I have chosen it.

²In this thesis, the term 'native language' is used synonymously with the term 'first language'. Similarly, for example, a 'native speaker' of German has German as a first language. See, amongst others, Paikeday (1985), Davies (2003), and Escudero and Sharwood-Smith (2001) who discuss the ambiguity and cultural connotations of the term 'native speaker', which are explicitly not implied here unless otherwise discussed (see Chapter 7).

focuses on the speech of native German speakers who have moved to either Anglophone Canada or the Dutch Netherlands.³

The thesis comprises two main experiments which examine different aspects of first language attrition in the domain of phonetics. Experiment I focuses on the *perception* of first language attrition in the native speech of German migrants to Canada and the Netherlands. The findings from this investigation set the stage for Experiment II, which examines the *production* of first language attrition in the speech of German migrants to Canada. Both experiments aim to investigate differences between and within migrants through exploring variation of first language attrition in the domain of phonetics.

The findings from this study have sociolinguistic significance regarding the dynamic languages of migrant communities, as well as theoretical implications for theories into first language attrition and second language acquisition.

1.1 Outline of the thesis

In the remainder of Chapter 1, the concept of first language attrition is explored. The focus is on studies related to phonetic aspects of first language attrition. Initially, Chapter 1 delivers an overview of hypotheses and models which contribute to an explanation of first language attrition at the level of pronunciation. Predictor variables, which potentially influence first language attrition, are also examined. At the end of Chapter 1, a general overview of the experimental design and the aims of the study are reported.

In Chapter 2, Experiment I is presented. The main objective of this experiment was to determine whether German migrants to either Canada or the Netherlands are *perceived* to be non-native speakers of their native German language by a group of monolingual German listeners in Germany.⁴ The assessing of a migrant's native German to be non-native, on the basis of his or her pronunciation, was interpreted as evidence for first language attrition. The second objective of Experiment I was to examine whether the L2 of either English or Dutch was associated with a migrant being perceived as a non-native speaker

³Unless otherwise specified, 'English' describes the standard variety of English which is spoken in Canada; 'German' refers to the standard variety of German which is spoken in Germany and 'Dutch' describes the standard variety of Dutch which is spoken in the Netherlands. There are admittedly many (potentially infinite) variants of these languages and, where necessary, more specific variation, for example as a result of regional accents, is discussed. Similarly, unless otherwise specified, although Canada, Germany and the Netherlands have numerous language communities aside from respectively English, German and Dutch, it is Anglophone Canada which is implied where Canada is referred to; the German language community where Germany is referred to; and the Dutch language community where the Netherlands is referred to.

⁴I use the term 'monolingual' to describe individuals with limited knowledge of additional languages. For further information regarding the definition of 'monolingual' and how this was controlled for, please see Sections 2.2.4, 2.2.5 and 3.2.2.

of German. Extralinguistic variables which were predicted to be related to the perception of foreign accented native speech were also investigated. More specifically, the influence of the following predictor variables was analysed: 1. age of arrival to Canada or the Netherlands, 2. length of residence in Canada or the Netherlands, and 3. amount and 4. type of contact with German.

In the subsequent chapters, Experiment II is documented. The foremost objective of Experiment II was to investigate whether selected phonetic elements in the native speech of German migrants to Canada underwent first language attrition in speech *production*. Specifically, Experiment II comprised an acoustic analysis of both segmental (the lateral phoneme /l/) and prosodic (prenuclear tonal alignment and pitch range) elements of speech. A secondary aim was to determine whether the L2 acquisition of the same phonetic variables was related to their L1 attrition. In doing so, two control groups, in addition to the migrant group, were examined: a group of German monolinguals in Germany and another group of English monolinguals in Canada. As in Experiment I, an analysis of the same extralinguistic variables aimed at shedding further light on variation in L1 attrition in the domain of phonetics.

The general methodology of Experiment II is presented in Chapter 3. Thereafter, Experiment II is divided into three chapters which are based on the selected phonetic variables. In Chapter 4, the analysis of the lateral phoneme /l/ is reported. In Chapter 5, the investigation of tonal alignment is discussed and in Chapter 6, the pitch range analysis is documented.

Finally, Chapter 7 consists of a general discussion of the results from both experiments, including their sociolinguistic and theoretical implications. Limitations of the research conducted are considered, and suggestions for future research into the topic at hand are presented.

1.2 First language attrition

This section of the thesis initially defines first language attrition. It discusses not only the background of research into first language attrition and its related fields, but also the ramifications of the term ‘loss’ when describing and explaining changes in a migrant’s first language. The aim is to focus on those studies which are of particular relevance to the present research, hence those which provide information regarding phonetic aspects of first language attrition.

1.2.1 What is first language attrition?

The term first language attrition has been defined in numerous ways. Differences in definition have accordingly brought about various research objectives and, due to similar terminology, the results of such studies run the risk of being inappropriately compared with one another. The term first language attrition in the present study is quite narrowly defined. Care should therefore be taken when comparing the results to other studies which use similar terminology.

Generally speaking, first language attrition can be defined as *the non-pathological loss of a native language within an individual* (Köpke and Schmid, 2004). This basic definition already alludes to the fact that language can be pathologically lost, such as in the case of aphasia. Aphasia may result when areas of the brain in which language is controlled are damaged, for example as a consequence of a stroke (amongst others Paradis, 1977; 2001). Studies into first language attrition on the other hand premise that the language loss under investigation occurred non-pathologically. It is this type of language loss which is dealt with in the present thesis.

More specifically, first language attrition refers to non-pathological language loss which is *not age-related*. Studies of the elderly provide evidence that certain language skills can change or decline as individuals grow older (Goral, 2004; Linville and Rens, 2001; Linville, 1996; Endres et al., 1971). This type of language loss, occurring in healthy aging, has also been described using the term ‘language attrition’ (Goral, 2004). Although age-related language loss is of relevance to the research at hand, it is first language attrition *in the context of bilingualism* which is the focus (Köpke, 2004).

The term ‘bilingual’ is used in this thesis to describe people who use two or more languages in their everyday lives (Grosjean, 1998; 2001). This definition focuses on the functional use of languages rather than on the language competencies of an individual. Accordingly, “bilinguals do not necessarily need to have perfect knowledge of all the languages they know to be considered as such” (Fabbro, 2001 : p. 201). Even Bloomfield, whose early definition is based on language competencies, conceded to the relativity of bilingualism. In 1933 he characterised bilingualism as the “native-like control of two languages”; however, “one cannot define a degree of perfection at which a good foreign speaker becomes a bilingual: the distinction is relative” (reprinted in 1984 : pp. 55 - 56). Crucially, lack of “perfection” in language competencies does not undermine the functional use of more than one language on the part of a bilingual.

Given that the migrants in the research at hand moved from Germany to an environment in which they acquired a new language, and continued to use their native language (albeit less frequently than in Germany), they are deemed to be bilinguals - regardless of

their potentially “imperfect” language competencies. More specifically, because these individuals learned their second language (either English or Dutch) in adulthood after their first language (German), they are referred to as *late consecutive bilinguals* (see amongst others Hamers and Blanc, 2000 and Wei, 2000 who differentiate different types of bilinguals). It is arguably what Bloomfield may have considered to be a lack of “perfection” in the native language of the bilingual migrants of the present study which is considered to be first language attrition in the present study.

Within the context of bilingualism, it is necessary to highlight the difference between functional and structural loss. Köpke (2004) defines language attrition as the “loss of the structural aspects of language, i.e. change or reduction in form, whilst ‘shift’ is a loss of functional aspects, i.e. the gradual replacement of one language by another with respect to language use” (p. 4). First language attrition in the present study is defined according to Köpke’s definition as *the structural loss of a native language*, rather than loss of use. According to Köpke’s terminology, it is feasible that an individual may have a reduction in use of his or her native language without undergoing structural loss. In the present study, functional loss of German, in an L2 migrant setting, *may* result in first language attrition, but it is the structural loss of the native language which is interpreted as evidence for first language attrition.

Returning to the initial definition of first language attrition, reference is made to loss within *an individual*. Fundamentally, a distinction must be made between the loss of a language within an individual and the societal loss of a language (de Bot, 2001; Schmid, 2002). As will be made clear in this section, this distinction is necessary for successful research into first language attrition. Societal loss occurs when there are fewer, or even no, speakers left of a particular language in a population that had once used it (Mufwene, 2004). For example, Bullock and Gerfen (2004a) document that in the originally French-English bilingual community of Frenchville, Pennsylvania, USA, there are now only two remaining fluent speakers of the French language. As such, the loss of French in this enclave represents societal loss. In its extremity, a language dies when no one speaks it anymore (Crystal, 2005).⁵ Language extinction can occur within a generation, for instance due to a natural disaster. An example of this is the case of the Tamboran language, which was brought to extinction as a result of a volcanic eruption on the island of Sumbawa in Indonesia (Nettle and Romaine, 2000). It can also occur intergenerationally: the extinction of the Beothuk people in Newfoundland, Canada, after the arrival of European settlers, coincided with the death of the Beothuk language (Marshall, 1996). When these

⁵Further clarification may be necessary when defining language death, for example dependent upon whether the language in question continues to be spoken by non-native speakers, such as in the case of Latin (Mufwene, 2004).

cases are contrasted to that of French in Frenchville, Pennsylvania, once the Tamboran and Beothuk people no longer existed, there were no other communities which continued to speak their languages. French, on the other hand, continues to be spoken in many other areas of the world.

These examples reflect societal language loss. Crucially, first language attrition does not *a priori* coincide with the loss of a language (be it in an enclave or in its entirety). For example, it has been found that British English native speakers, who moved to Germany in adulthood, had reduced competencies in certain (non-phonetic) linguistic domains of their English (Dostert, 2004). Such findings point towards first language attrition (hence structural loss), but they do not coincide with an overall reduction of English native speakers. Similarly, in the present study, when investigating first language attrition in German native speakers, the claim is not made that German itself is a potentially endangered language, nor that the German language in Canada and the Netherlands is threatened.⁶

Alternatively, it is feasible for societal loss of a language to occur without first language attrition. An extreme example of this is that of the sudden death of the Tamboran people of Indonesia (Nettle and Romaine, 2000). In this case, language extinction (i.e. societal loss) did not coincide with the structural loss of the Tamboran language within individual speakers (i.e. first language attrition). The reason for emphasising this distinction is that, in research, societal and individual loss run the risk of being inappropriately equated with one another. This essentially means that when investigating a language which is undergoing societal loss, whether within an enclave or in its entirety, it is necessary to distinguish between that which has been lost *due to first language attrition* and that which has been lost *due to a lack of intergenerational transmission*.

This crucial distinction can be brought to light by presenting a study by Celata and Cancila (2005). Their study investigated what was termed to be ‘first language attrition’ at the level of phonology in the Italian-Lucchese community of San Francisco (Celata and Cancila, 2005). Two perceptual tests, both investigating the ability of participants to dif-

⁶In fact, present immigration policies indirectly support the influx of German native speakers to both Canada and the Netherlands. In 2001, Canada’s immigration policy set a long-term goal of recruiting 300,000 immigrants annually, or approximately one percent of its population. This legislation allows for the high percentage of German migrants in Canada to remain stable. In the recent 2001 Census, German was the third most common non-official mother tongue after Chinese and Italian in Canada. Of the 438,080 Canadians who indicated that German was their mother tongue in the 2001 Census, 84,605 lived in British Columbia, the province where the present recordings were made. This made German the third most common non-official mother tongue after Chinese and Punjabi in this province (taken from Statistics Canada, www.statcan.ca). In the Dutch Netherlands, place of origin, or ‘*Bevolking naar herkomstgroepering*’, is documented, rather than mother tongue. In the Netherlands, foreigners, or ‘*allochtonen*’, of German origin represent the second largest group after those from Indonesia. In 2000, 401,000 individuals who originated from Germany lived in the Netherlands (taken from *Centraal Bureau voor de Statistiek*, www.integratie.net). Open EU working policies allow these numbers to remain stable in the Netherlands.

ferentiate between singleton (short) and geminate (long) consonants, were the focus. This distinction is not made in English and the hypothesis put forth was that the second generation of Lucchese migrants to the United States would differentiate between these consonants less than the first generation of Lucchese migrants due to first language attrition in the second generation. This was in part the case: the second generation differentiated between singleton and geminate consonants less than the first generation. However, one cannot attribute this lack of differentiation in the second generation to first language attrition. This is because the assumption that the second generation had in fact ever *acquired* the distinction (from the first generation) is premature. Acquisition of this distinction on the part of the second generation may have been prevented because the first generation did not make the distinction consistently (in fact, the Lucchese dialect makes less use of this distinction than does Standard Italian (Celata and Cancila, 2005)), or because the first generation simply had to a large degree stopped speaking Lucchese with their children. In the case of migrant communities in both Canada (Marmen and Corbeil, 2004) and the US (Grosjean, 2001), it is quite accepted that intergenerational - functional - language loss occurs in non-English speaking language communities. Lack of acquisition on the part of the second generation may also have been caused by *the first generation having undergone first language attrition*. Fundamentally, lack of intergenerational transmission of this distinction, whatever the reason, may in turn have resulted in the second generation simply never having acquired the distinction. Without confirming acquisition, it is impossible to determine loss. In other words, you can't lose it, if you haven't got it.

In contrast to Celata and Cancila's study (2005), the present study investigates the first generation of German migrants to either Canada or the Netherlands. The participants are late consecutive bilinguals who acquired their native language fully and as adults moved to a country where contact with this language was reduced. The challenge of disentangling lack of intergenerational transmission and individual loss is therefore less problematic, as intergenerational loss is bypassed. Hence in the study at hand, native language loss which occurs within this first generation is attributed to loss *within the individual*, rather than to intergenerational loss.

I now return to the original definition of first language attrition. Examining the definition more closely, *the loss of a person's native language*, rather than his or her second language, is specified. In contrast to first language attrition, second language attrition (Bahrick, 1984) may occur when, for example, an adult acquires fluency in a language during a stay abroad, but thereafter ceases to maintain contact with this language.⁷ First

⁷According to Krashen, the process of *learning* a foreign language is characterised by explicit, formal instruction in the L1 environment, whereas second language *acquisition* is characterised by the attainment of implicit knowledge, generally in an informal, L2 environment (1981). The terms 'learn' and 'acquire'

language attrition on the other hand specifies the fact that it is the native, or first language, which is the subject of examination. This distinction assumes to a certain extent that differentiating between a first and a second language is unproblematic; however, this is not always the case. When examining simultaneous bilinguals (as opposed to consecutive), who have learned both their languages at more or less the same time in childhood, differentiating the L1 from the L2 becomes more difficult.

The relevance of this distinction is illustrated by means of the previously mentioned study by Bullock and Gerfen (2004a). Although the term ‘attrition’ is applied in Bullock and Gerfen’s investigation into the French speech of French-English bilinguals in Frenchville, Pennsylvania, there is a fundamental difference between the study at hand and that of Bullock and Gerfen. This difference boils down to the individuals in Bullock and Gerfen’s study having acquired both English and French semi-simultaneously in an English dominant environment. It is noted that the two brothers in their study, the last speakers of French in this community, had lived in Frenchville all of their lives. “The language they spoke at home was exclusively French until they married and moved out of their parents’ home in their early twenties” (p. 306). This suggests that although they spoke French at home while growing up, the rest of their environment was English dominated. Determining whether the participants’ French had undergone attrition, a claim Bullock and Gerfen make, therefore becomes problematic. This is because one cannot be sure how much French, a language on the brink of complete decimation in Frenchville, the participants in their study had actually acquired. Although French may have been their first language (it being the first they were exposed to), the continued acquisition of this language may have been influenced by English. In this light, it is difficult to speak of attrition because, as already discussed, the term assumes that something (in this case the distinction between the two front rounded vowels [œ] and [ø]) was at one point acquired, and thereafter lost (hence replaced by the English rhoticized schwa, [ə]) (Bullock and Gerfen, 2004a: p. 304)). Similarly, in Celata and Cancila’s (2005) study, the participants may have had Lucchese as a first language, it being spoken in their home environment. However once the participants entered school, English quite possibly gained in dominance, potentially influencing the acquisition of Lucchese. Summarising, because the acquisition of French and Lucchese may have been influenced by English during the process of bilingual language acquisition, it is difficult to ascertain that first language attrition (which presupposes acquisition beforehand) is in fact the central topic of these studies.

are used interchangeably in this thesis, both with reference to the L1 and the L2. This is due to the fact that in the case of the participants’ L2 (English or Dutch) learners have in many cases acquired, or learned, both implicit and explicit knowledge, making it impossible to disentangle the two. Moreover, in the case of the L1, it may also be likely that implicit and explicit knowledge are inextricably linked. Krashen’s distinction is therefore not adhered to in the present thesis.

Notably, some acoustic investigations provide evidence which suggests that the L1 and L2 phonetic systems of early, or simultaneous, bilinguals influence one another (Caramazza et al., 1973; Watson, 1990; Khattab, 2000; Gordeeva, 2006; Sundara et al., 2006). An initial study by Caramazza et al. (1973) indicated that the phonological systems of early French-English bilinguals are “not completely free from interlanguage interference” in adulthood (p. 427). Their study investigated the production and perception of voice onset time (VOT) in simultaneous French-English bilingual adults, who learned French first, but English no later than their seventh birthday (Caramazza et al., 1973). In this way, their bilinguals were akin to those in Bullock and Gerfen’s (2004a) study who similarly spoke French at home and learned English at school. The results from Caramazza et al.’s investigation revealed that interlanguage interference was most evident at the perceptual level, whereas a unidirectional influence from French to English was observable at the level of production. When relating Caramazza et al.’s (1973) results to that of Bullock and Gerfen’s (2004a), attention is directed towards the finding that both French and English influenced each other in their semi-simultaneous acquisition, and that this was evident in adulthood. The results from a more recent study by Sundara et al. (2006) emphasise that the L1 and L2 phonetic systems of bilinguals influence one another in *simultaneous* bilingualism. Their study focused on adults who had learned both English and French simultaneously at home from their parents, and continued to live in a bilingual environment thereafter. Sundara et al. (2006) make the claim that previous instrumental studies which revealed language interaction in simultaneous bilingual children potentially investigated incomplete acquisition, given that the bilingual child’s exposure to each language is likely to be less than that of a monolingual child’s. The focus of their study was on /d/ and /t/ in word initial position in Canadian French (CF) and English (CE). These coronal stops were analyzed for differences in VOT, relative burst intensity and burst spectral measures, the latter measurements indicative of place of articulation (described as dental in French and alveolar in English). Their findings suggested that simultaneous bilingual adults did not differentiate coronal stops to the same extent that monolingual speakers of English and French did (Sundara et al., 2006). For example, “unlike the pattern observed for monolingual speakers, there was no consistent difference in relative intensity between CE and CF tokens produced by bilingual speakers” (p. 106).

Summarising, the results from these instrumental investigations indicate that the L1 and L2 phonetic systems of simultaneous or early bilinguals may influence one another (Watson, 1990; Khattab, 2000; Gordeeva, 2006) - and that this interactional effect can be observed in adulthood (Caramazza et al., 1973; Sundara et al., 2006). This is of course not to say that interaction occurs in all phonetic areas between the L1 and L2, nor that phonetic interaction is inevitable; but rather to emphasise that phonetic interaction is pos-

sible, and that studies into first language attrition need to account for this. Accordingly, it is quite difficult to ascertain whether the distinction not made by Bullock and Gerfen's (2004a) bilingual adults between the two front rounded vowels [œ] and [ø] had actually ever been acquired, and as previously discussed, this is the presupposition for a phonetic feature thereafter being lost, or undergoing attrition.

In the case of the participants of the present study, who acquired their German L1 in Germany and who migrated to either Canada or the Netherlands in late adolescence or adulthood, it is possible to assume that L1 acquisition occurred fully before L2 acquisition. Although these late consecutive bilinguals may have been knowledgeable of their second language prior to their move, contact to English or Dutch dramatically increased upon migration. In other words, by ensuring that German was fully acquired in a monolingual environment, it is likewise ensured that native language acquisition was not influenced by another language, whether through early or simultaneous bilingualism.

In summary, I emphasise the definition of first language attrition as used in this thesis: *the non-pathological, non-age related, structural loss of a first language within a late consecutive bilingual, assuming that the acquisition of the first language precedes its loss*. In particular, the focus is on the pronunciation of the native language, within the domain of phonetics. It is the situation of migrants all around the world, who move to a new country, exposing themselves to a new language and a new culture in adulthood, to which this definition is of relevance.

1.2.2 What does 'loss' mean?

In the previous section, it was emphasised that first language attrition is rather precisely defined in this thesis, and that care should be taken when comparing the present results to those of other studies using similar terminology. In the present section, an additional aspect of first language attrition is examined : what does 'loss' actually mean?

Cook (2003) indirectly challenges the very use of the term 'loss' when referring to bilinguals. He notes that "the usual context for discussing possible harmful effects of the L2 on the L1 is language loss or attrition... Research into this has mostly been carried out in the context of the loss of the first language by people who are spending their lives in a situation where it is not used for their major everyday social and professional purposes, whether as immigrants or expatriates" (Cook, 2003 : p. 12). He continues that when describing bilingual subjects, "Positive and negative evaluations of differences are to some extent problematic in that they rely on a value judgement about what is good and what is bad" (Cook, 2003 : p. 12). In other words, he questions the ramifications of the term 'loss' to describe what is essentially a (potential) consequence of *acquiring* a second

language in a migrant context. It is in this vein that his book is entitled “The Effects of the Second Language on the First” and that his contribution to the same book is entitled “The Changing L1 in the L2 User’s Mind” (Cook, 2003). The terms ‘effect’ and ‘change’ are notably preferred over ‘loss’. This is a valid criticism of the latter wording, assuming that the use of the term consists of a value judgement. I do not avoid the term. Instead, I explain the exact meaning of ‘loss’ in this thesis and in doing so emphasise that it is in no way my intention to “judge other people as failures” on the basis of their language (Cook, 2003 : p. 4).

In essence, when the term ‘loss’ is used within the definition of first language attrition in the present thesis, it is equivalent to the following definition: the non-pathological, non-age related, structural *change* to a first language within a late consecutive bilingual, assuming that acquisition of the first language precedes its *change*. The term ‘loss’ in my definition of first language attrition is however maintained because its presence emphasises that the first language was, in fact, fully acquired and that the ‘changes’ occurred thereafter. ‘Loss’ emphasises diachronic, in contrast to synchronic, change. The term is in this way descriptive of the participants of the present study. ‘Changes’ in their native language have occurred after their native language was fully acquired and are therefore not comparable to the effects of the second language on the first in simultaneous, or early bilingualism (Watson, 1990; Khattab, 2000; Gordeeva, 2006; Caramazza et al., 1973; Sundara et al., 2006). The participants moved to Canada and the Netherlands during late adolescence or within adulthood after having grown up in a monolingual German environment. Accordingly, it is possible to investigate whether, after the participants’ move abroad, the phonetic elements of their native language ‘changed’. The term ‘loss’ describes a chronological occurrence; it does not judge.

At this point, given that the term ‘loss’ in the present thesis is to a certain extent equatable with Cook’s definition of ‘change’ (albeit with an emphasis on the fact that the first language was acquired fully before the second language), the next question arises. The question is whether the loss is permanent. In answering this question, it is possible to make reference to Chomsky’s original differentiation between competence and performance (1965). In the past, demonstrating first language attrition at any linguistic level has almost exclusively been accomplished by comparing the language performance of a group of bilingual migrants in their native language with the language performance of monolinguals from the migrants’ country of origin in the same language (see Hutz, 2004 for a review). This is, in fact, the same methodology as applied in the present study. In such cross-sectional studies, if the performance of the bilinguals is different from that of the monolingual control group, the assumption made is that first language attrition has occurred. However it stands to reason that the question not addressed in such studies

is whether or not the loss is permanent. Essentially, this means that it can be counter-argued that the language performance of a bilingual cannot be equated to his or her actual competence. The elements of the native language which deviate from the norm, or the performance of the monolingual group in the country of origin, may in fact be stored - and in the proper environment retrieved. This differentiation between performance and competence deserves further debate.

Originally, Sharwood-Smith (1983) drew attention to the competence performance dichotomy in the field of first language attrition. According to his description, performance attrition reflects difficulties in *control of native language knowledge*; whereas competence attrition entails a restructuring of what is known about the language. Sharwood-Smith (1983) suggests that competence and performance in first language attrition may be displayed in three distinct phases. The first stage is characterized by systematic deviations in performance while competence remains stable. In the next stage, a transitional period becomes evident in which the bilingual is in possession of a new hybrid variety, but the ability to switch back to the old variety when required is preserved. The last stage represents the emergence of a reduced competence characterized by a decrease in structures available to the speaker. In the present study, the attempt is not made to investigate whether observed first language attrition is reflective of one of these stages. This is to say that when late consecutive bilinguals display deviations from the monolingual norm of the control group, it is assumed that, *at the very least*, a loss of structural control (representing performance attrition) is evident, although the possibility of permanency of loss (competence attrition) cannot be discounted.

Very few studies have aimed to specifically investigate the permanence of first language attrition, or an underlying competence. An objective of those which have done, or do, is to examine the impact of training on the performance of bilinguals in their L1. Here the theoretical question is whether individuals who demonstrate the loss of a particular aspect of their native language at the level of performance (for example after migration to a country in which there is reduced contact to the native language) are able to 'relearn' that which was lost. Crucially, such participants must 'relearn' that which was lost *faster* than another group of participants *who had never learned that which is under investigation*. Only if the 'relearners' (i.e. those who were initially assessed to exhibit first language attrition) do so faster than the 'first-time-learners' (i.e. those who are learning the aspects for the first time), is it possible to ascertain that an underlying competence in the relearners was an advantage. In other words, although the relearners might suffer at the level of performance, which would be interpreted as first language attrition, they might maintain an underlying competence, which was simply not evident before training. The resulting argument could be that the migrants had in fact not undergone first language attrition (if

it is defined in terms of loss of competence, or permanency). In theory, this is a valid question. In practice, however, it is next to impossible to investigate. This is because the probability of finding two groups, on the one hand composed of relearners, and on the other hand composed of first-time-learners, who are at *exactly* the same (performance) level, is next to none. The competence issue is therefore, essentially, the black box of research into first language attrition.

In fact, adopted children potentially represent the only group in which such an investigation can be practically conducted. For these individuals, if adopted in early childhood, exposure to the initial language is limited. The idea behind such studies (Tees and Werker, 1984; Au et al., 2002; Oh et al., 2003; Pallier et al., 2003; Ventureyra et al., 2004; Park, 2007) is that when the individuals are investigated later on, after they have acquired the language of their new environment, a language test (in the initial language) can verify that the performance level of the adoptive group is the same as that of a control group which had never undergone early exposure. In this way, the equivalence of the performance level in the control and experimental group is more likely to occur (i.e. both groups, at least superficially, display no knowledge of the language under investigation), so that the presence of an *underlying* competence in the experimental adoptive group can be investigated. Simply put, it is because the performance of the adoptive group is the same as the performance of the experimental group which makes the former attractive in these studies. Unfortunately, research addressing the competence versus performance issue in individuals who have undergone early language exposure, such as in the case of adoption, (Tees and Werker, 1984; Au et al., 2002; Oh et al., 2003; Pallier et al., 2003; Ventureyra et al., 2004; Park, 2007) presents conflicting results.

For example, Ventureyra et al. (2004) examined first language attrition at the level of phonetics when a language is “acquired” in early childhood, before adoption, but exposure to it is discontinued at a young age. They investigated whether adopted Koreans, who were raised in France, were better at discriminating Korean voiceless consonants, which are difficult to perceive by native French speakers, than native French speakers who had never been exposed to Korean in early childhood. The results from their study indicated that the adopted Koreans did not perceive the differences between Korean phonemes better than native French speakers who were previously unexposed to Korean. In other words, it was claimed that the adopted Koreans who had been raised in France had undergone first language attrition, as there was no longer any presence of that which was assumed to have once been acquired (Ventureyra et al., 2004). In further studies, their results were confirmed by Pallier et al. (2003) whose investigation indicated that similar adopted Koreans, who had been raised in France, displayed event-related activation patterns in

functional magnetic resonance imaging (fMRI)⁸ which did not differ while listening to Polish, an unfamiliar language, and Korean. This suggests that the brain was activated equally by these two languages. Together, the studies indicate that a language overheard in early childhood can in fact be completely forgotten. Relating this to the competence performance dichotomy, it appears that the adopted children did not have an underlying competence, concealed at the level of performance.

To a certain extent, such results contradict other, similar investigations. Au et al. (2002) found that native English participants taking Spanish lessons in adulthood spoke Spanish with a more native-like accent if they had overheard Spanish regularly in early childhood than if they had not. Oh et al. (2003) came to a similar conclusion based on both speech perception and production tasks regarding English speakers exposed to Korean before the age of five and English speakers hearing Korean for the first time in a language class for adult learners. Those who had heard Korean in early childhood “outperformed” novice Korean learners in the perception but not production of Korean phonemes (Oh et al., 2003). Similarly, those who had spoken Korean in early childhood “outperformed” those who had heard Korean in early childhood and novice Korean learners in phoneme production (Oh et al., 2003). Ventureyra et al. (2004) however argue that the bilinguals in Au et al. (2002) and Oh et al.’s (2003) studies “either came from immigrant communities or grew up in communities where the attrited language was used” (2004 : p. 82).⁹ Accordingly, they argue that when they were later tested as adults, their capabilities were not indicative of first language attrition because the language under investigation had not ceased to be activated. This suggests that the results from the above studies may contradict one another because the participants differed from one another.

As suggested in an unpublished study by Bowers and Mattys, the relevant question to ask is whether preserved knowledge is visible when contact with the initial language is completely cut off *after training* (Bowers and Mattys, forthcoming). Their study investigates the fate of early-acquired phonological knowledge when the language in question is subsequently unused. A preliminary analysis suggests that participants who were exposed to either Zulu or Hindi in early childhood, and subsequently immersed in an English language environment, have an advantage over control subjects, who were only ever exposed to English. Training was offered to both groups, and a preliminary analysis

⁸Functional magnetic resonance imaging (fMRI) is a technique which can be used to localise active areas of the brain. When an area of the brain is active, it consumes more oxygen than when it is inactive. To meet an increased demand for oxygen, blood flow increases to the active area and it is this activation which can be documented using fMRI. For a complete explanation of fMRI and its applications, the reader may refer to Huettel et al., 2003.

⁹Note that in their study, the term ‘attrition’ is used synonymously with disuse (p. 79). In contrast, as already discussed, in the present study, first language attrition is not defined on the basis of functional loss, or lack of use, but rather on the basis of structural loss (Köpke, 2004).

suggests some experimental subjects acquired phonological distinctions characteristic of their early childhood language (but not of English) noticeably faster than both the control subjects and the alternative language. These preliminary results suggest that when it comes to language loss, the effects of training may re-activate an underlying competence which is in fact present, although before training the language superficially appears to have been completely forgotten.

The above studies are specifically relevant when determining how permanent loss actually is when language use ceases in childhood. A crucial point to be made regarding all of them is that one cannot be sure how much of the initial language was actually acquired (the difference between lack of acquisition in comparison to attrition was discussed in Section 1.2.1). Difficulties arise from the fact that when a deficiency in the initial language system is experimentally observed, one cannot be completely certain if this is due to the characteristic having been lost - or contrarily never having been acquired to begin with (Köpke and Schmid, 2004 : pp. 9 - 12). In other words, it is arguable that in studies investigating language disuse in children, those which do not detect an underlying competence, may be a result of a competence (which may amount to some sort of language stabilisation) never having been attained.

The age of migration in studies into first language attrition reflect this important point. A researcher can determine with a relative degree of certainty on the basis of an individual's age at departure from his or her home country to what extent the first language was acquired. Generally, research into first language attrition (which adheres to the present definition) therefore examines individuals who move abroad at the age of 16 or after. This ensures that the first language was in fact fully acquired.

Much of the research on recovering aspects of a native language when contact ceases in adulthood is based on anecdotal reports, or observational. Yağmur et al. (1999) investigated Turkish native speakers who had moved to Australia in adulthood. The researchers pointed out that participants in their study displayed a marked decrease of L1 lexical skills in Australia, but when they returned to Turkey every four to six years, they “do not experience much difficulty in understanding or speaking Turkish” (1999 : p. 59). Two studies mention what may amount to the successful retraining of lost phonetic elements in native speech. These are those of Major (1992) and Sancier and Fowler (1997). Both of these studies are examined more closely in Section 1.2.3. For the moment, it is of importance to mention that in the former study it is reported that one of the English native speakers who had moved to Brazil recovered her native accent shortly after returning to the United States (Major, 1992). The latter study similarly found that native Brazilian Portuguese speakers reported a stronger foreign accent in the pronunciation of a native Brazilian Portuguese speaker after her extended sojourn in the United States in comparison to after a

return to Brazil (Sancier and Fowler, 1997). These findings indicate that what appears to be lost in a certain environment is in fact an access problem due to the lack of appropriate contexts and retrieval cues. Temporarily inaccessible structures may be recovered if the right cues become available, such as those which are available in an individual's home country (Ecke, 2004). In other words, performance may not be a reflection of competence.

However, as previously discussed, it is in fact not known in these studies whether the participants had 'relearned' the aspects of the native language under investigation (which means that in the second language environment the structures were inaccessible, but not permanently lost), or whether they had acquired them as a 'first-time-learner' would have, meaning that they were in fact completely forgotten. In theory, a study investigating this would need to involve an adult 'first-time-learner' with exactly the same knowledge as the adult 'relearner', in order to determine whether they (re-)learned at different rates. In practice, as already mentioned, finding such equally matched adult participants is with all likelihood impossible. This means that the question - of whether or not native language 'loss' in late consecutive bilingual migrants is permanent, and hence a reflection of competence rather than performance - is similarly with all likelihood unanswerable.

Even though the issue of competence versus performance in first language attrition is problematic, the argument is at times made, when the presence of first language attrition is suggested in studies (at least at the performance level), that one cannot be certain that the loss is permanent, and hence therefore *not really lost*.¹⁰ I argue that this argument is weak because the fact that such studies do not prove attrition at the level of competence does not likewise *disprove* it. Moreover, if, given the problems of experimental design described above, it is accepted that proving first language attrition at the level of competence is akin to cracking the black box, the research question as such may represent a dead-end. At the very least, it must be acknowledged that when late consecutive bilinguals display deviations from the monolingual norm of the control group, the minimal assumption to be made is that this reflects a loss of structural control in the native language. The permanency of the loss remains open for debate, although proving or disproving either way seems unlikely. However, by including loss of control into a definition of first language attrition, one logically, in effect, by-passes the argument that attrition is only just this when loss occurs within competence. Perhaps more importantly, the sociolinguistic impact of native language loss, or change, in bilingual migrant communities is more clearly acknowledged when change of structural control is included in a definition of first language attrition.

Another argument used to disqualify results indicating first language attrition is cross-

¹⁰Here I note general conference communication.

sectional methodology (Jaspaert and Kroon, 1989; Yağmur, 2004). This argument does not focus on the differentiation between competence and performance but rather on diachronic language change. The argument claims that the native language of bilingual migrants may differ from the language of the monolingual control group (assuming this is the same language), not because the bilingual migrants have undergone first language attrition, but because the language of the monolingual control group has changed since departure from the country of origin (see for example Harrington, 2006). It has therefore been suggested that longitudinal studies be incorporated into first language attrition research, although here the methodological problem is that the repeated testing of variables may disturb the “natural course of the process it [the test] hoped to track down” (Jaspaert and Kroon, 1989 : p. 81). This issue will be explored in more detail in Section 7.1. For now, it is important to state that, as will be shown, because there was interpersonal variation across the experimental group (some migrants performing similar to the control group and others not), it can be counter-argued that, at least with regard to the phonetic elements investigated, the speech of the control group resident in Germany had not changed since the experimental group emigrated. It is for this reason that when differences between the German control group and the experimental group are detected, they are interpreted as evidence for first language attrition.

Summarising, it is the undertaking of the present thesis to examine first language attrition, and hence structural loss, in the native speech of German migrants to Canada and the Netherlands. In doing so, the terms do not pass judgement. They are descriptive of a chronological occurrence, rather than of a specific type of loss, be it at the level of competence or performance.

It is therefore the focus of this thesis to examine the speech of the consecutive bilingual migrants at a particular *moment*, here the moment of investigation. It is such moments, varied in form they are, from visits or telephone conversations to the country of origin, to conversations with fellow migrants in the recipient country, which characterise native language contact for many migrants. In essence, this study investigates such a moment.

1.2.3 First language attrition in the domain of phonetics

As already mentioned, the majority of research regarding first language attrition in adults has addressed linguistic levels such as the morphology, syntax, semantics and lexicon of the native language system (Köpke and Schmid, 2004). The present section concentrates on studies which have investigated first language attrition (according to the definition at hand) in the domain of phonetics.

As discussed in Section 1.2.1, given that the studies by Bullock and Gerfen (2004a)

and Celata and Cancila (2005) did not differentiate between structural language loss within an individual (aka first language attrition) as opposed to intergenerational loss and language interaction in the case of early bilingual acquisition, their results are not presented here. Moreover, instrumental studies which have investigated what may amount to child first language attrition in the domain of phonetics in bilingual language acquisition are not explored here (see Section 1.2.2). The focus of such studies (Caramazza et al., 1973; Williams, 1980; Khattab, 2000; Gordeeva, 2006; Sundara et al., 2006) was *not* on adult second language acquisition in the case of late consecutive bilingualism. Language interaction between the L1 and L2 phonetic systems in the participants of these studies, whether as children or adults, can therefore not be interpreted as evidence for (or against) first language attrition as defined here.

According to the definition at hand, there has only been one study which systematically explored first language attrition within the domain of phonetics. Major (1992) investigated five female native speakers of American English who had been living in Brazil for 12 to 35 years. The earliest age of arrival to Brazil was 22 years of age, and the latest was 36 (Major, 1992 : p. 192). The participants in his study were married to Brazilian nationals, raised their children speaking Portuguese, and were highly integrated into the Portuguese speaking community in Brazil. In addition to their active use of Portuguese, his subjects used English on a daily basis, as they were all either English teachers or administrators in an English language institute (p. 192). Major examined the voice onset time (VOT) of the phonemes /p t k/ in the speech of these late consecutive bilingual migrants, because previous studies have indicated that VOT in Portuguese is significantly shorter than in English (Major, 1987). His results revealed that “to a greater or lesser extent, all the subjects suffered loss of native English proficiency” (Major, 1992 : p. 200). In general, there was also a correlation between proficiency in the second language, measured according to the realisation of Portuguese-like VOT, and rate of attrition in the native language. On average, the lower the VOT (less native-like) in the English casual speech of his participants, the lower the Portuguese VOT was (more native-like). However, this correlation was not displayed when the participants’ formal English speech was examined (formal speech was elicited through word and sentence lists whereas casual speech was taken from informal spontaneous conversations). In other words, there was a tendency for L1 loss to mirror L2 acquisition in casual speech (p. 203).

Yet when *individuals* were explored, “the results of the bilingual speakers showed a variety of patterns in their relative mastery of Portuguese and their ability to retain native-like English proficiency” (p. 193). For example, subject B3 and B4’s VOT realisations were significantly different from *both* English and Portuguese native speakers’ in formal and casual speech. Subject B1 and B2’s VOT realisations showed little loss of English

in formal and casual speech and “produced Portuguese relatively poorly compared to the others” (p. 193). According to Major (1992), subject B5 was “perhaps the most interesting” because she produced formal English and Portuguese VOT precisely within their respective norms, yet showed “severe loss in English casual speech” (p. 194). Simply put, Major’s (1992) late consecutive bilinguals showed a high degree of both inter- and intrapersonal variation with regard to first language attrition in the domain of phonetics. Moreover, L1 attrition was not *per se* mirrored by L2 acquisition in all of the bilinguals - take subject B3 who performed poorly in English and Portuguese, in comparison to subject B5, who at least in formal speech performed within the monolingual norms of English and Portuguese. This suggests that other variables, aside from the acquisition of the second language, may have had an impact on first language attrition in the domain of phonetics in these bilingual migrants.

In addition to Major’s (1992) study, a particular investigation by Flege (1987) investigated the VOT of the stop consonant [t] in both American English native speakers who had been immersed in a French-speaking community in France and in French native speakers who had been living in the United States for over a decade.¹¹ Similar to in Major’s study, Flege’s (1987) English L1 migrants had initially acquired their L2 in “late adolescence or early adulthood” (p. 51), and the same is implied for the French L1 migrants (p. 52). “Most of them [the English native speakers] had children who spoke French as their principal language and attended French-speaking schools”, although they spoke English with their children to encourage bilingualism (p. 52).

In terms of first language attrition in the domain of phonetics, Flege (1987) summarised the results of his study by suggesting that phonetic properties of similar L1 and L2 phones were “merged” in the late consecutive bilingual migrants (p. 62). His results are reproduced in Figure 1.1. As shown, in both of the L1 migrant groups, the characteristic VOT of their native language became more like the VOT of their second language, decreasing for the American English native speakers living in Paris, and increasing for the French native speakers living in Chicago. In fact, both first and second language phonetic systems were deviant from - but intermediate to - the respective monolingual norms (Flege, 1987). Within the same study, he also found that the native French speakers, “for whom English was clearly their principal language” (p. 52), produced French /u/ with a mean frequency of the second formant (F2) that was higher (1333 Hz) than the value he obtained for his French monolingual subjects (1196 Hz). Moreover, in their English /u/, they approximated the English monolingual values (p. 58). Although the results from the vowel analysis were not significant, they too suggest that the prolonged acquisition of an

¹¹Flege’s Speech Learning Model (SLM) (1995, 1999, Flege et al., 2003), which predicts that L2 learning will affect the production of phones in an L1, will be specifically explored in the following section 1.3.2.

L2 phonetic system in a migrant setting may affect the L1 phonetic system.

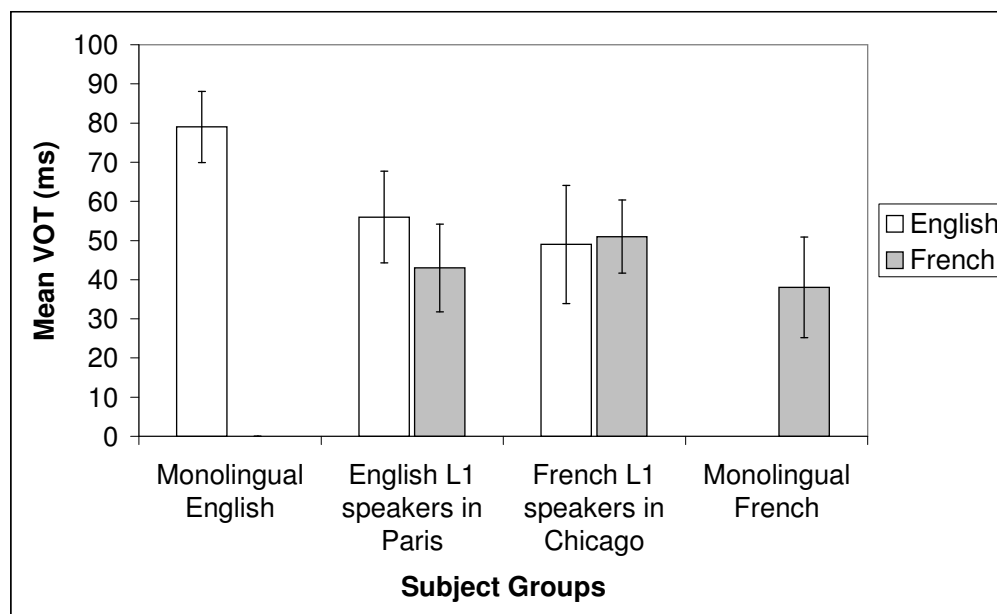


Figure 1.1: Merging effects in the VOT of /t/ on the part of English native speakers in France and French native speakers in the United States. Reproduced from Flege (1987).

Finally, with reference to Major’s (1992) study, it should be noted that the focus of Flege’s (1987) investigation was on group trends, rather than on potential differences *between* the late consecutive bilingual migrants who comprised the group(s). However, upon closer examination of the standard deviations in Figure 1.1, interpersonal variation in the late consecutive bilinguals is evident. More specifically, the standard deviation of the French L1 speakers in Chicago, in their French, overlaps with the French monolinguals’ standard deviation. Similarly, the standard deviation of the English L1 speakers in Paris, in their English, approaches the standard deviation of the English monolinguals. Such results are in fact indicative of interpersonal variance within the late consecutive bilinguals, suggesting that some migrants may have displayed “merging” effects, whereas others did not.

Another study by Flege and Hillenbrand (1984) investigated a very similar group of French native speakers, who had all learned English as adults and had been living in an English-speaking environment for an average of just over 12 years. These late consecutive bilingual migrants were all married to native English speakers and, again, the VOT of their /t/ in both French and English was examined. Similar to in the study just described, the averaged results of the participants indicated that in general the VOT of /t/ in their French was substantially longer (and more English-like) than that of monolingual French speakers (Flege and Hillenbrand, 1984). Moreover, in the same study it was reported that

“the migrant French native speakers produced French /u/ with a substantially higher mean F2 value (1387 Hz) than previously reported for monolingual French speakers (987 Hz)” (p. 717). In other words, the long-term exposure to English may have influenced their production of French /u/, causing it to be more English-like, just as it influenced their production of French /t/. In comparison to Major’s (1992) study, it is again emphasised that the focus of Flege and Hillenbrand’s (1984) investigation was on group differences, rather than on inter- or intrapersonal differences within the speakers who comprised the groups.

In addition to ‘merging’ effects, similar research into the speech of consecutive bilinguals has suggested that the acquisition of an L2 can have a polarisation effect on the phonetic systems of the L1 and L2. In a study of Dutch native speakers who were highly proficient in English as a second language, which they had begun learning at 12 years of age in the Netherlands, bilinguals produced their Dutch /t/ with shorter VOT values than a group of Dutch L1 speakers who were less proficient in English (Flege and Eefting, 1987). These effects are displayed in Figure 1.2. As shown, in the highly proficient participants, the Dutch /t/ moved away from both the typical English value and the typical Dutch value (becoming shorter). Flege and Eefting (1984) suggest that this may be a result of ensuring sufficient discrimination between the L1 and the L2 segment. Although this study did not deal with migrants, nor with individuals who had learned their L2 in adulthood, the results suggest that similar L1 and L2 phones may undergo polarisation effects. This research therefore augments the previously discussed studies which revealed ‘merging’ effects.

Interestingly, except for a single case study by Sancier and Fowler (1997), global foreign accent in native speech has yet to be investigated. Sancier and Fowler’s study found that native Brazilian Portuguese speakers reported a stronger foreign accent in the pronunciation of a native Brazilian Portuguese speaker after her extended stay in the United States in comparison to after a return to Brazil. Consistent with Flege’s (1987), Flege and Hillenbrand’s (1984) and Major’s (1992) results, Sancier and Fowler also observed that the VOT of the voiceless labial plosive ([p] in Brazilian-Portuguese and [p^h] in American-English) and the voiceless alveolar plosive ([t] in Brazilian-Portuguese and [t^h] in American-English) were generally longer in her US sessions than in the Brazil session. In this regard, Sancier and Fowler (1997) potentially provide evidence for an underlying language competence in their late consecutive bilingual; however, as discussed in Section 1.2.2, differentiating between learning for the first time and relearning is problematic. Moreover, although their study indicates flexibility in the phonetic systems of a consecutive bilingual, because just one subject was assessed, it is difficult to determine whether such effects would be confirmed across a larger group. Nevertheless, the study

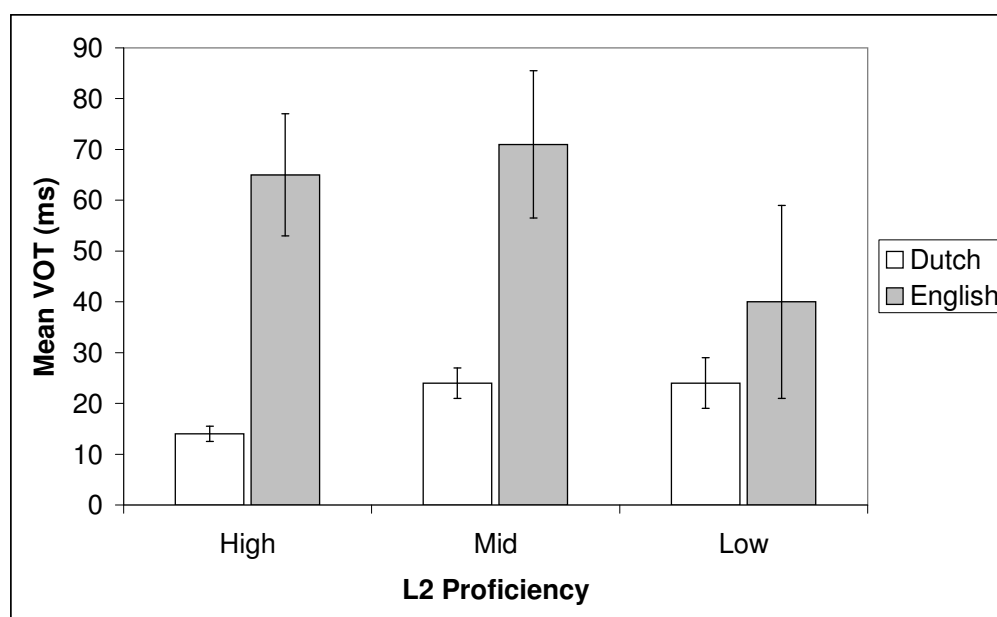


Figure 1.2: Polarisation effects in the VOT of /t/ on the part of Dutch native speakers with varying proficiency levels in English as a second language. Reproduced from Flege and Eefting (1984).

also provides support for divergence from a native speaker norm - here at the more global level of foreign accent - in an L2 migrant setting.

With regard to prosodic elements of speech, only one study has to date studied bi-directional interference in the intonation of native speech (Mennen, 2004). Mennen investigated native Dutch speakers who were at a near-native level in their acquisition of Greek as a second language. Her participants had learned Greek in early adulthood, and were teaching Greek at university level in the Netherlands (Mennen, 2004). She found that four out of five of her speakers were not only unable to realise Greek tonal alignment authentically, they also showed a change in their native Dutch tonal alignment patterns under the influence of Greek (Mennen, 2004).¹² More specifically, the differentiation in the alignment of pitch peaks across Dutch long and short vowels was greatly reduced in their L1 speech. Only one speaker produced tonal alignment with native-like values in both the L1 and L2. This study similarly indicates mutual effects of the L1 and L2 systems in late consecutive bilinguals, yet here at the level of prosody.

The results of Mennen's (2004) study moreover give reason to investigate interpersonal differences within a seemingly homogenous group of second language learners, particularly because one participant produced both Dutch and Greek tonal alignment according to native speaker monolingual norms. In the case of this late consecutive bilingual,

¹²The term 'tonal alignment' will be defined in detail in Chapter 5.

L1 loss did not mirror L2 acquisition, nor did this speaker's phonetic systems undergo merging or polarisation. Accordingly, this participant resembled the patterning displayed by the late consecutive bilingual migrant of Major's (1992) study who realised VOT in both her L1 of English and her L2 of Portuguese according to the monolingual norms in formal speech.

Summarising, previous studies suggest that it is possible for specific phonetic elements in a native language system to diverge from their original state, or undergo first language attrition, when a second language is acquired as an adult. The studies propose different explanations for this divergence. On the whole, evidence for interaction between the L1 and L2 phonetic systems is suggested. On the other hand, both Major (1992) and Mennen (2004) describe late consecutive bilinguals who realised the phonetic elements under investigation in *each* of their languages successfully. Such findings challenge the inevitability of interaction between the phonetic systems of late consecutive bilinguals. They moreover give reason to explore interpersonal, as well as intrapersonal, variation of first language attrition in the domain of phonetics. It is this which the present investigation aims to do.

1.3 Explaining phonetic first language attrition

The previous section explored studies which provide information into phonetic aspects of first language attrition, according to the definition used in this thesis. The studies which were discussed suggest that there may be a degree of heterogeneity in first language attrition of the phonetic domain in late consecutive bilinguals.

In the present section, the basic question is: how can first language attrition in the domain of phonetics be explained? The section initially draws upon theoretical frameworks which have been established due to previous studies into first language attrition, investigating generally higher, linguistic levels (for an annotated bibliography see Schmid, 2004 and for a collection of relevant essays consult the book 'Language Attrition : Theoretical Perspectives' (2007)). Thereafter, the section draws upon L2 speech models. The focus when exploring these models is to discuss their meaning with regard to first language attrition. The relevance of these theoretical frameworks and models is directed towards both a general explanation of first language attrition in the domain of phonetics, as well as towards a potential explanation of inter- and intrapersonal variation. At the end of this section, predictor variables which may influence first language attrition are explored. Notably, the present research was designed to test neither the theoretical frameworks regarding L1 attrition nor the L2 speech models; however, their description does aim to

facilitate an interpretation of the results.

1.3.1 Theoretical frameworks for first language attrition

As a starting point, it can be asserted that theories regarding first language attrition are intrinsically related to those regarding L2 acquisition. This is because L2 acquisition, according to the definition at hand, is a necessary although not sufficient condition for first language attrition. Therefore, in order to examine L1 attrition, one must view it, at least partially, in light of L2 acquisition.

There is a fundamental assumption which all theories of L2 acquisition make. This is the assumption that there is a difference between an L1 and an L2. More precisely, this is to say that, in fact, the L1 makes claim to a “privileged status” (Schmid and Köpke, 2007 : p. 1). A proposed reason for this privileged status is the fact that a person’s L1 has unique access to the ‘clean slate’. In other words, a child acquiring his or her L1 is in an initial state, which is no longer present once development has progressed. The consequence of this is that a major component of the initial state for L2 learning *must be prior knowledge of the L1*. There is disagreement over precise boundaries as to when an L2 actually becomes just this: for example, is part of the initial state still left when a child starts school? Moreover, there is debate over whether the L1 can actually even make claim to such a privileged state, or whether the processes involved in acquiring an L2 are, at least in part, the same as those required for L1 acquisition. Although this debate persists (see, for example amongst others, Long, 1990 and Hyltenstam and Abrahamson, 2003 in contrast to, amongst others, Bongaerts et al., 1997 and Moyer, 1999), in light of their very nature, theories specifically assessing L2 acquisition assume that there is, in fact, at least something which distinguishes the L1 from the L2. Similar to theories of L2 acquisition, theories focusing on L1 attrition assume a fundamental difference between an L1 and an L2. This is to say that according to these theories, losing aspects of an L1 is different from losing those same aspects in an L2. It is this premise which most, but not all, theories in L1 attrition and L2 acquisition have in common. It is perhaps a result of this intrinsic similarity that many L1 attrition theoretical frameworks stem from theories originally based on L2 acquisition.

Take the Interlanguage Hypothesis, which commences the exploration of theoretical frameworks into first language attrition. This hypothesis was initially introduced by Selinker in 1972 to refer to the dynamic stages an L2 passes through as it moves toward the target L2. This system, which is continually changing, is thought to have its own characteristics and be separate from the L1 and L2. The original acknowledgement of an interlanguage (at least in terms of Selinker’s 1972 reference to L2 acquisition) arose

in part from the deficiencies of the Contrastive Analysis Hypothesis (Lado, 1957; Fries, 1945). In terms of L2 acquisition, this latter theory hypothesises that when aspects of a first and second language are similar, positive transfer will take place (from the L1 to the L2), but where the languages are different, negative transfer will occur (Lado, 1957). In other words, where languages are different, L2 acquisition will be more difficult than where they are similar. In terms of L1 attrition, this means that similarity would hinder first language attrition, whereas dissimilarity would promote it. The predictive power of the contrastive analysis was doubted as it became apparent that, on the one hand, it was in fact often the opposite which occurred and that “the strange is often more readily recognized than the apparently familiar” (Baird, 1967 : p. 131). Moreover, learners’ negative transfer could not always be predicted through the L2. Some L2 learners displayed errors which could neither be attributed to the L1 nor the L2 (Wode, 1981). Such observations made way for the notion of an interlanguage, characteristic of which is some degree of autonomy.

Schmid (2002) originally identified the ‘interlanguage’ in an attempt to explain first language attrition. Investigations into first language attrition turned the original theory around and examined whether the native language is affected by the acquisition of a second (Schmid, 2002). Change, or loss, within a native language, which has been induced by the acquisition of a second, has parallels with the notion of ‘reverse transfer’ (Jakobovitz, 1970). This term more specifically describes the process of the L2 infringing upon the L1, which in turn contributes to the interlanguage.

Even if change in a person’s native language superficially appears to be externally induced, hence *caused* by the acquisition of a second language, attributing first language attrition solely to the acquisition of the second language (as the Contrastive Analysis Hypothesis and to a large extent the Interlanguage Theory do) is not always possible (Seliger and Vago, 1991). Changes in a person’s native language may alternatively be caused by internally induced change, as, for example, the Regression Hypothesis theorises. The Regression Hypothesis was integrated into a linguistic framework by Roman Jakobson, specifically with regard to phonology in the case of aphasics (Jakobson, 1941, as quoted by de Bot and Weltens, 1991). In brief, the theory states that “[t]he pattern of language dissolution in aphasics is similar, but in reverse order, to the pattern of language acquisition in children” (Caramazza and Zurif, 1978). Although the general conclusion is that with regard to aphasia the Regression Hypothesis is largely untenable (Caramazza and Zurif, 1978; de Bot and Weltens, 1991), it has been recently investigated within the realm of first language attrition (Keijzer, 2004). Here the prediction is that the order of attrition is the reverse of acquisition. In a recent study, the Regression Hypothesis was tested in relation to the loss of morphology and syntax in Dutch migrants to Anglophone Canada

(Merel, in preparation). The results indicated that first language attrition, as it would occur according to the predictions of the Regression Hypothesis, was most evident in the domain of morphology, but not in syntax, which was mostly characterized by L2 influences from English. This is to say that solely internally induced change could not explain the evidenced first language attrition. Nevertheless, the importance of L1 change which cannot be attributed to the acquisition of the L2 is emphasised by Dorion (1982) in her study of language death in Scotland: “Perhaps the errors in a half-forgotten language have a logic of their own too ... and are not simple interference phenomena” (p. 57). Following this line of thought, first language attrition may result in phenomena within the L1 which resemble neither the L1 nor the L2. If this argument is taken a step further, one can question whether ‘gaps’ in a native speaker’s L1 were there first, and then ‘filled’ with L2 elements, or whether the L2 elements intruded upon the L1 system initially (Schmid, 2002). In other words, although phenomena in the L1 may resemble the L2, they may not actually have been *caused by* the L2.

The idea that first language attrition may, in fact, occur as a result of rules which are independent of the languages involved, introduces another theoretical perspective. A full explanation of Universal Grammar goes far beyond the scope of this thesis and is not attempted here. Initially it must be asserted that a fundamental assumption of Universal Grammar is that language is a unique, or innate, form of cognition (Chomsky, 2002). A main argument supporting Universal Grammar is the poverty of the stimulus argument. This argument stipulates that knowledge of language goes beyond what could be learned from the input received, hence there must be a common set of rules from which language is generated (Chomsky, 2002). In terms of first language attrition, it is the Minimalist Program, a further development of Universal Grammar, which is most influential. Briefly, this construct can be conceptualized as a set of principles which are properties of all languages (Chomsky, 2002). Some of these principles contain parameters, which are characterised by a choice of setting, dependent upon which language is involved (Chomsky, 2002). Within the framework of L1 attrition, it may be questioned, for example, whether a parameter, which has already been set in L1 acquisition, can be neutralised as a result of prolonged L2 acquisition (Schmid, 2002; Tsimpli, 2007). According to this perspective, first language attrition may only affect interface properties because it is only these which are interactive in nature (Tsimpli, 2007). The role of markedness also plays a role in such investigations, because the hypothesis assumes that certain parameter settings, those which are unmarked, are preferred over others, which are marked (Schmid, 2002). The continual process of changing parameter settings in L2 acquisition, and hence L1 attrition, gives rise to what is similarly termed the ‘interlanguage’. Crucially, the theory maintains that the underlying competence of a speaker’s L1, which is determined by the

architecture of an innate language faculty, is unaffected by first language attrition. This theoretical perspective therefore emphasises the “privileged status” (Schmid and Köpke, 2007 : p. 1) of the native language. The focus is on determining where and why the interface boundaries in an individual’s grammar occur, as only these reflect first language attrition.

Studies emanating from a psycholinguistic perspective are intrinsically different from those based upon the Minimalist Program. The former maintain that language (and hence the process of losing it) is not a unique form of cognition. Native language loss occurs as the result of information processing, which is not characteristic of language alone, is at the heart of a psycholinguistic perspective. Specifically with regard to first language attrition, psycholinguistic perspectives theorise that the role of memory is essential within processing. Differentiating between procedural and declarative knowledge and how this relates to language loss is a goal of such studies. According to Ullman (2006 and 2007), neurocognitive evidence suggests that in an individual’s first language, lexical knowledge depends on the declarative memory system, whereas grammar relies on the procedural memory system. Proponents of this theory claim that learners of an L2 initially depend largely on declarative memory. In first language attrition, knowledge previously stored in the procedural memory is transferred to the declarative memory (Ullman, 2007). This explanation of first language attrition, that *unused* aspects of an L1 may be stored in different memory systems, very briefly summarises the essence of the psycholinguistic theoretical framework regarding first language attrition.

Language disuse has been pinpointed in the Subsystems Hypothesis. This hypothesis was originally proposed as a neurolinguistic theory of bilingualism, but has recently been applied within the framework of first language attrition (Paradis, 2007; Köpke, 2007). One of the main implications of this theory is that there is no qualitative difference between types of bilinguals, at least with respect to neurofunctional systems (Paradis, 2007). As such, the theory may be applicable to simultaneous as well as late consecutive bilinguals, such as in the case of the participants in the study at hand. Put more precisely, this hypothesis claims that there is, in fact, nothing special about an L1 due to it having been acquired first. Instead, the Subsystems Hypothesis proposes that two independent subsystems function within one linguistic system (Paradis, 2004 : p. 210). The ability to inhibit or activate a particular subsystem, or network, is controlled by the cognitive system. The ‘activation threshold’ of each subsystem is determined by numerous factors. When the activation threshold is low, the activation of its subsystem is facilitated; whereas when it is high, the subsystem is more difficult to activate (Paradis, 2004). According to Paradis (2004), the activation threshold is determined by the frequency and recency of language experience, as well as by an individual’s personal motivation (Paradis, 2004; Paradis,

2007). Specifically with regard to L1 attrition, Köpke (2007) summarises that L1 use will be affected by lack of resources due to the necessity to strongly inhibit the more highly activated and more easily accessible L2. Inhibition, the process of ‘blocking’ particular items, may therefore also play a role in the control of bilingual processing (Paradis, 2007; Green, 1986).

Notably, the Subsystems Hypothesis emphasises on the one hand change within the bilingual individual (dependent upon use, the activation threshold can rise or fall), and on the other hand, more recently, the role of the individual through motivation (Paradis, 2007). Consequently, the bilingual *individual* has a degree of control over the activation threshold in that he or she influences use and disuse of a particular language. The Dynamic Systems Theory, too, argues for a perspective which emphasises the bilingual individual across his or her lifespan. According to this theory, language, and L1 attrition more specifically, can be viewed in line with a developmental lifespan perspective which incorporates language gain and loss at all ages (de Bot, 2007). The emphasis in this theory is moved from viewing language as semi-static (with terminology like ‘final state’ and ‘fossilization’) to interpreting language developments as processes which may occur throughout life. Specifically, “[I]inguistic decline may have its basis in biological changes, but the interaction between psychological and social changes will affect the rate of decline” (de Bot, 2007 : p. 56). Moreover, according to this theory, unpredictable changes in language development are expected which cannot be explained by either the influence of the L2 on the L1 or language internal processes. The Dynamic Systems Theory coincides with the call for a multicomponential view of first language attrition (Köpke, 2007). According to a multicomponential perspective, plasticity, inhibition, and activation all play a role in first language attrition, as do cognitive processes (such as, for example, the procedural and declarative memory systems), but, crucially, none of these determinants develop in isolation. Instead, they are “in permanent interaction with the subject’s social environment” (Köpke, 2007 : p. 22).

Perceptively, Jordan (2004) comments on the proliferation of current theories of L2 acquisition. Similarly, as demonstrated above, theories in L1 attrition are numerous. Categorising these theories is perhaps futile. Some theories address the cognitive and neurobiological dimension, others the sociological and sociolinguistic dimension of first language attrition (Schmid, 2007b). I have emphasised a main difference in that some theories assume a difference between an L1 and an L2 (e.g. Universal Grammar), whereas others do not (e.g. the Subsystems Hypothesis). Another difference which was discussed is that some frameworks lean towards an external intralinguistic explanation for first language attrition (e.g. the Interlanguage Hypothesis, the Contrastive Analysis Hypothesis), whereas others towards an internal intralinguistic explanation (e.g. the Regression

Hypothesis). Alternatively, the Dynamic Systems Theory, as well as the Subsystems Hypothesis, incorporate extralinguistic factors, such as language contact and motivation, into their frameworks. In this way, they account for differences between bilingual speakers. Alternatively, a psycholinguistic perspective focuses on the cognitive processing of linguistic information in relation to first language attrition. Importantly, all of the discussed theoretical frameworks address *all* linguistic domains, including the domain of phonetics.

Although the aim of the present research was not to test a specific theoretical framework within the domain of phonetics, the description of these theories potentially aids an interpretation of the results. It is perhaps a multicomponential framework, incorporating various aspects of the above theories, which will be most fruitful when examining potentially exhibited first language attrition here.

1.3.2 L2 speech models and L1 attrition

This section addresses second language speech models, and how they are relevant to first language attrition. The theories themselves do not directly approach the issue of first language attrition, but are interpreted in this light given the object of the research at hand. In applying these models to first language attrition, the source of L1 loss is largely constricted to interaction between the phonetic systems of the L1 and the L2. As briefly approached in the previous section, there is a danger in this assumption, as it is unknown whether interference is *caused by* an intruding L2 system, or whether L2 phonetic qualities take over an L1 system which is *already* undergoing attrition, for different reasons aside from solely the acquisition of the L2 (Dorian, 1982; Schmid, 2002). The likelihood of particular segments in an L2 being influenced by the first language (and within the realms of the present investigation, similarly, to what extent the segments of the L1 are influenced by the acquisition of an L2) is therefore the focus of this section.

Just as theories into first language attrition are related to theories into second language acquisition, L2 speech models can be looked at in relation to other models. Ultimately, L2 speech models aim at explaining the perception and production of non-native speech sounds. As pointed out by Tuller et al. (2008), learning to perceive a non-native speech sound may be considered an instance of the more general issue of categorisation, and “theories regarding categorization are abundant in psychology” (Tuller et al., 2008 : p. 209).

According to the differentiation offered by Tuller et al. (2000), most present L2 speech models can be described in relation to exemplar-based models of category perception. Tuller et al. (2008) consider Kuhl’s Native Language Magnet (NLM) Theory as a well known example of an exemplar-based approach to categorization of speech stimuli. This

theory in the first instance predicts how a first language is acquired, but its application in L2 acquisition is useful. The NLM Theory is based around the native language magnet effect which describes a phenomenon originally detected by Kuhl (1991). The perceptual magnet effect is “the finding that the best members of a category function like perceptual magnets for surrounding stimuli” (Kuhl, 1997 : p. 145). Specifically, Kuhl and her colleagues have found that the perception of the same acoustic stimuli are categorised differently dependent upon the native language of a speaker (Kuhl, 1991; Iverson and Kuhl, 1995; Kuhl, 2004). The NLM Theory “accounts for a change from a language - general mode of speech perception to one that is language - specific” (Kuhl, 1997 : p. 145). Before around six months of age, infants do not display the native language magnet effect, but as their L1 is acquired, poor discrimination in the region of prototypic exemplars of phonetic categories in their native language become evident (Kuhl, 1997; Iverson and Kuhl, 1995). Although Kuhl’s NLM was specifically developed with regard to the acquisition of native (monolingual) speech, findings which support the existence of a perceptual magnet effect may help explain some aspects of second language learning in adults (Iverson and Kuhl, 1995). For example, in line with this effect, Kuhl and her colleagues have shown that early language experience can impede the acquisition of non-native phonemes during adulthood in second language acquisition (Iverson et al., 2003; Iverson and Kuhl, 1995). In a specific experiment investigating the perception of English /r/ and /l/ by Japanese, German, and American adults, the results suggest that “language - specific perceptual processing can alter the relative salience of within - and between - category acoustic variation, and thereby interfere with second language acquisition” (Iverson et al. 2003 : p. B47). In their study it was found that F2 is a greater perceptual cue in distinguishing English /r/ and /l/ for Japanese native speakers than it is for German native speakers, although F3 has a greater perceptual weight for English native speakers. This means that prototypes established in L1 acquisition influence the perception, and ultimately acquisition, of L2 stimuli. Furthermore, it is crucial in terms of L2 speech models that acoustic stimuli may be the same, but according to the perceptual magnet effect *be categorised differently*, in line with the prototypes of different languages (Kuhl, 1993). When relating the NLM theory to the research at hand, the question arises whether an originally acquired L1 phonetic prototype can be influenced by the acquisition of an L2 prototype. The NLM theory does not address this possibility of restructuring dynamic categories in the L1 but rather ascertains that the perception of phonetic segments in an L2 *is* influenced by L1 prototypes (Tuller et al., 2008).

The Speech Learning Model (SLM) specifically addresses not only the acquisition of speech sounds in an L2, but also makes reference to how L2 acquisition affects the L1. This is most relevant to the study at hand. It should be emphasised that this model has

developed considerably over the past two decades (Flege and Hillenbrand, 1984; Flege, 1987; Flege, 1995; Guion et al., 2000a; Flege et al., 2003). Accordingly, it is attempted here to provide the most recent interpretation of the model in relation to both its development and the research at hand, that of first language attrition in the domain of phonetics.

A focus of the SLM is on ultimate attainment, “so work carried out within its framework focuses on bilinguals who have spoken their L2 for many years, not beginners” (Flege, 1995 : p. 238). According to the SLM, it is those sounds which are most similar which are *most difficult* to learn for L2 language learners (Flege, 1995; Flege et al., 2003). A similar sound (i.e. a sound in the L2 which is similar to that of a sound in the L1) is more likely to be classified into the same category as that of the native language. A new category, on the other hand, is more likely to be created for a dissimilar sound (originally termed ‘new’ (Flege, 1987) in the L2 language learner). Long-term pronunciation problems are, according to Flege, more likely in the case of similar sounds than in dissimilar sounds as equivalence classification prevents experienced second language learners from producing similar, but not dissimilar sounds, authentically (Flege, 1995). When equivalence classification occurs, “a single phonetic category will be used to process perceptually linked L1 and L2 sounds (diaphones)” (Flege, 1995 : p. 239). This notion of equivalence classification has strong parallels with Kuhl’s NLM Theory which argues that the nearer an L2 sound is to an L1 sound (specifically to its prototype), the more it will be assimilated to this L1 sound (Kuhl, 1997 : p. 137). In relation to the present research, the SLM however goes one step further in its claim that the L1 may be affected by the acquisition of the L2 (Flege, 1987; Flege and Hillenbrand, 1984; Flege et al., 2003).

Crucial to studies in first language attrition, the SLM predicts that “the more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from the L1 phonetic norm” (Flege et al., 2003 : p. 470), although this effect is greater in late than in early bilinguals. Similar L1 and L2 speech sounds can interact through two mechanisms: assimilation occurs when no new category in the L2 is established, whereas dissimilation (or polarisation) occurs when a new category in an L2 speech sound is perceived. In relation to first language attrition, this means that the successful acquisition of an L2 sound (which is deemed similar to an L1 sound) will lead to the ‘merging’ (or assimilation) of its L1 counterpart. Category dissimilation occurs because “bilinguals strive to maintain phonetic contrast between all of the elements in their L1 / L2 phonetic space, just as monolinguals strive to maintain phonetic contrast among the elements making up their L1 phonetic space” (Flege et al., 2003 : p. 470). In other words, according to the SLM, two interaction processes may occur in L1 attrition and L2 acquisition: assimilation and

dissimilation, depending on whether new categories are formed for similar sounds.

The SLM furthermore predicts that any L2 learner, whether child or adult, is able to establish a new phonetic category for an L2 sound which is *perceived* to be sufficiently dissimilar from the L1 sound. However, age does affect how the L1 and L2 phonetic sub-systems interact. “That is, as L1 vowels and consonants develop, they will perceptually assimilate neighbouring L2 vowels and consonants more strongly” (Flege et al., 2003 : p. 469). “This leads to the prediction that, all else being equal, early bilinguals will be more likely to establish new phonetic categories for L2 speech sounds than late bilinguals will be” (Flege et al., 2003 : p. 469). In essence, this is to predict that category assimilation will be more likely to occur in late bilinguals than in early bilinguals, who will be more likely to display dissimilation (Flege et al., 2003).

Interestingly, what the SLM does not acknowledge is the perception of L1 elements (which in production have either been merged or polarised from their L2 counterparts) on the part of the listener. This is to ask how, if similar items are merged or polarised, does a second individual, potentially a monolingual of the L1, perceive this assimilation or dissimilation? If Kuhl’s perceptual magnet effect is taken into account, the listener will in fact perceive such slight phonetic deviances to be equivalent to an already established prototype. This means that the L2 learner, (in the case of the present study the bilingual migrant), may in fact not be perceived as less native like in his or her L1, because he or she is utilising a common phonetic space in which a similar phonetic item is perceived according to the language background of the listener. This idea is explored in greater detail in Chapter 7.

The notion of similarity, and whether it promotes dissimilation or assimilation, is also intrinsic to Best’s Perceptual Assimilation Model (PAM) (1995). According to this model, the similarity between L1 and L2 sounds is based on the perceived resemblance of articulatory gestures used to produce L2 sounds, in comparison to those used to produce the closest L1 sound. In a sense, this model goes a step further than the SLM, because it takes a position on how similarity is assessed on the part of the L2 speaker, namely through phonetic-articulatory gestures. Best (2003) goes so far as to compare the complex gestures of speech with the temporally layered movements of a dance (“sequenced movements of feet, of legs, of whole body; movement across the stage, etc.”) (p. 615). Different assimilation patterns are possible which predict the degree of difficulty in the perception of an L2 contrast. Although in Best’s model phonetic similarity is seen “in terms of gestural constellations”, in their empirical studies “gestural similarities are defined abstractly; no actual measurements of articulatory parameters are included” (Strange, 2007: p. 38). The model has strong parallels with the Motor Theory of speech perception, proposed by Liberman and Mattingly (1985). This theory claims that “the objects of speech percep-

tion are the intended phonetic gestures of the speaker, represented in the brain as invariant motor commands that call for movements of the articulators through certain linguistically significant configurations” (p. 2). The Motor Theory does not directly attempt to explain L2 speech acquisition, and because of this, it will not be explained in more detail here. Nevertheless, parallels between the Motor Theory of speech perception and PAM are conspicuous, as according to PAM, the listener decodes the acoustic signal using information based on his or her articulatory production. However, PAM does not predict a potential effect the acquisition of L2 gestural movements has on the articulatory components of the L1. As such, its predictive value for first language attrition is limited.

Given that the SLM has the most predictive value for first language attrition, a critical analysis of this model follows. On the one hand, as already described, the SLM relies on the concept of cross-language phonetic similarity (Mennen, 1999; Mennen, 2004; Strange, 2007). However, there is consensus among researchers that measures of phonetic similarity often fail to correctly predict difficulty in perception or production of L2 segments (Bohn, 2002). Place of articulation, manner of articulation and voiced versus non-voiced describe consonants on the basis of a broad phonetic transcription, whereas the horizontal and vertical range of the vocal tract, as well as rounding, have become standard parameters to describe vowels. It is unclear as to which of the many parameters used to describe speech sounds must be satisfied in order to label two sounds as being similar. Flege (1991) acknowledges this problem, emphasising that “no satisfactory method now exists for determining whether an L2 vowel will be treated as new or similar” (p. 704). In other words, in terms first language attrition in the domain of phonetics, if the notion of similarity is too elusive, the predictive power is weak.

A second reason as to why the SLM is not comprehensive in predicting phonetic first language attrition is based on the fact that languages differ in the way they sound not only because of differences in their respective phoneme inventories, but also in their realisation of non-segmental elements of speech. The SLM has so far not attempted to account for prosodic aspects of speech, either in L2 acquisition or L1 attrition (Flege, 1995; Mennen, 1999; Mennen, 2004; Strange, 2007). Moreover, the SLM has evaded the notion of phonetic settings (Mennen et al., in preparation). The term phonetic setting refers to a language-specific habitual or neutral position of the vocal apparatus (Laver, 1980). For example, languages may differ in their degree of lip-rounding, tension of the lips and tongue, jaw position, phonation types, pitch range and register. The SLM fails to account for such non-segmental aspects of speech.

Moreover, linguistic context is not accounted for. For example, it is questionable whether specific sounds are more likely to assimilate or dissimilate in specific linguistic contexts. Imaginably, one factor may be the lexical item in which the sound occurs. It

stands to reason that it would be more difficult for a speaker to produce a dissimilar sound in the context of other dissimilar sounds. Moreover, would it not differ if the specified sound was produced in a cognate, as opposed to in a completely ‘new’ word? Such questions suggest a potential level of intrapersonal *inconsistency* within the production of L1 and L2 sounds. However, the SLM predicts consistency in the speech of individuals. In fact, it may be very likely that the production of a particular sound within a bilingual is variable (Khattab, 2002), and that this may be dependent upon numerous factors, such as the word in which the sound occurs, as well as the linguistic, or phonetic, context. Unfortunately, studies which provide evidence for the SLM often look at means of particular phonetic qualities of sounds (as outlined in Section 1.2.3), rather than at interpersonal or intrapersonal variation of these sounds. An underlying assumption in these analyses is that there is stability within the items analysed, from which a mean is created. Research into variation within the same phonetic variable, as the present research attempts, may in fact yield different results.

Finally, it is claimed that the setting, or environment, in which the individual bilingual speaker is immersed, is not adequately accounted for by the SLM. A context in which “all other factors are equal” (Flege et al., 2003 : p. 469) is the basis of the model. But what are all these other factors, and are they actually ever equal in bilingual communities and individuals? Or do they develop over time, as part of a dynamic, changing system? In the SLM, it is assumed that age of acquisition and static language internal factors determine achievement in an L2, and, in the context of the present study, potentially also L1 attrition. Learner specific variables, aside from age of acquisition, are in this way sidelined and the unique environment and characteristics of the individual play a less substantial role (Markham, 1997). Yet given that some highly fluent L2 speakers, who were all late consecutive bilinguals, in the research conducted by Major (1992) and Mennen (2004) realised the investigated phonetic elements within *each* language according to the noted monolinguals’ realisations, additional factors aside from an inevitable assimilation or dissimilation of similar sounds in a seemingly homogenous group may need to be accounted for in an explanation of second language acquisition and first language attrition in the domain of phonetics. Whether these factors change *over time*, and how they change, can be acknowledged in a dynamic approach to language change (de Bot, 2007; Sharwood-Smith, 2007; Tuller et al., 2008). In other words, language external factors may play a role in determining inter as well as intrapersonal language variation. The following section specifically addresses such extralinguistic predictor variables which may account for differences across speakers regarding language development and, in particular, first language attrition.

1.3.3 Predictor variables

In the preceding sections, the concepts of first language attrition and loss, particularly in the domain of phonetics, have been explored. In the present section, the emphasis is on predictor variables which may affect the process of phonetic first language attrition. As will be discussed, these predictor variables are incorporated to varying degrees into the previously discussed theoretical frameworks and speech models.

To begin an analysis of extralinguistic predictor variables, it is necessary to differentiate them more explicatedly from intralinguistic predictor variables. In the context of the present thesis, intralinguistic variables can be defined as within-language factors which may contribute to first language attrition. For instance, as previously discussed, the SLM incorporates an intralinguistic predictor variable in the claim that sounds which are similar between the L1 and the L2 will be more likely to undergo assimilation than sounds which are dissimilar. The Regression Hypothesis also refers to intralinguistic predictor variables, the assumption being that language internal factors allow for predicting first language attrition. Linguistic elements of an L1 which are acquired first are the most stable and the least likely to undergo first language attrition. As discussed, Dorion (1982) has similarly made reference to language internal intralinguistic factors (“Perhaps the errors in a half-forgotten language have a logic of their own too ... and are not simple interference phenomena” (p. 57)), which may induce first language attrition. In the critical assessment of the SLM in the previous section, I noted that the linguistic context in which a particular sound occurs (for example whether the sound in question occurs beside similar or dissimilar sounds, or whether it occurs in a cognate or a non-cognate) may influence its realisation and potentially its rate of attrition. This factor may also be seen as an intralinguistic predictor variable, as the focus remains within the domain of the language(s).

Throughout the course of the preceding sections, it was suggested that solely intralinguistic predictor variables - either those caused by interference or those caused by language internal factors - are not adequate in accounting for first language attrition. Alternatively, it was proposed that extralinguistic predictor variables, which can be used to characterise individual speakers, may also play a role in determining first language attrition. An analysis of extralinguistic predictor variables may explain variability in first language attrition. As previously discussed, some studies into first language attrition, here particularly in the domain of phonetics, have revealed inter- and intrapersonal variability across seemingly homogenous bilingual groups (Major, 1992; Sancier and Fowler, 1997; Mennen, 2004) (see Section 1.2.3). Such results prompt the question of why individuals in these groups produced varying results, and it is potentially extralinguistic predictor

variables, which characterise speakers and their environments, which may assist in an explanation of this question. In other words, if the intralinguistic variables within a group are similar, but variation in first language attrition is evidenced, extralinguistic variables may illuminate the cause of such variation.

Moreover, as already briefly discussed in Section 1.3.1, an analysis of extralinguistic variables need not be viewed as a second step after the analysis of intralinguistic variables. Even when gaps in a user's L1 are filled by the L2 (suggestive of intralinguistic variables having prompted the change), one may argue that the gaps were potentially initially *caused by* extralinguistic variables, and then filled by the L2 variable. Here the question is whether intralinguistic variables gave rise to the language change, or whether the change was prompted by extralinguistic variables - which then express themselves in the form of an intralinguistic variable.

Generally speaking, extralinguistic variables can be categorised into those which describe individual characteristics of speakers (internal extralinguistic predictor variables), and those which describe the particular setting, or environment, in which a speaker is immersed (external extralinguistic predictor variables). Schmid (2002) refers to this dichotomy in her description of individual and community factors. Individual factors can be viewed as "the classic sociolinguistic variables like age, gender, education etc., as well as the amount of contact the individual has with the attriting language and the length of her stay in the country of emigration" (Schmid, 2002 : p. 19). These internal factors contribute to describing the uniqueness of the individual speaker, which in turn may aid in explaining speaker variability within a dependent variable. It has been previously asserted that language capabilities (hence gain and loss) are developed "in permanent interaction with the subject's social environment" (Köpke, 2007b : p. 22). External predictor variables describe this social environment in which the speaker finds him or herself, for instance, whether in a given society a particular language is considered to be a prestige language, or whether the ethnolinguistic vitality of the language in question is high or low (Schmid, 2002 : pp. 26 - 29).

Strict adherence to the above division of extralinguistic variables into internal and external factors lacks reference to the multicomponential nature of predictor variables (Köpke, 2007) (see the end of Section 1.3.1). When explaining first language attrition, a multicomponential perspective accounts for the interconnected characteristic of variables, particularly in cluster variables. For example, age of acquisition can be viewed as an internal extralinguistic predictor variable in determining first language attrition, but it is typically confounded with other variables. Brain plasticity (more brain plasticity likely being present in children than in adults), motivation (the motivation to maintain a first language may be related to age of L2 acquisition), the amount of language contact a migrant

has (in a migrant setting, children in school generally have less L1 language contact and more L2 language contact than their parents), and the length of residence in the recipient country (an early age of acquisition, or arrival to the new country, is often correlated with a longer length of residence) (Köpke, 2007b; Piske et al., 2001) may all be interconnected with age of acquisition. Hence when investigating age effects, it is of course not the chronological number which is at the route of attrition, but rather an underlying, or potentially numerous underlying and interconnected, factors which determine age effects.

According to the SLM, the assumption is that acquiring the sounds of an L2 occurs with more ease the younger L2 acquisition takes place because “the phonetic categories used to produce and perceive the phonetic segments distinguishing L1 words are hypothesized to become more powerful attractors of L2 vowels and consonants as they develop through childhood and into adulthood” (Flege et al., 2003 : p. 469). In line with the SLM, one may predict that the older a bilingual is when he or she learns his or her L2 in a migrant setting, the more stable the L1 is and the less likely he or she will be to approximate the (monolingual) phonetic norm of the L2 and, likewise, undergo attrition of the L1 phonetic norm. This prediction corresponds to research into first language attrition which suggests that “the younger the child is when the language of her environment changes, the faster and deeper she will attrite” (Köpke and Schmid, 2004 : p. 10). However, as differentiated by Bylund (in preparation), research on age effects in L1 attrition tend to focus on *either* children *or* adults. This leads to indirect evidence for age-related differences in L1 attrition, as the studies are not directly comparable with each other. Still, a healthy adult speaker has of yet never been reported to exhibit a degree of attrition as dramatic as that found in child attriters (Bylund, in preparation). Ultimately, age of acquisition may therefore be a powerful predictor variable in determining first language attrition, potentially reflecting various internal and external extralinguistic variables.

Given that the present study investigates German native speakers who migrated in late adolescence or adulthood, the effects of age of arrival (AOA) (here, as will be discussed, synonymous with age of acquisition) are expected to be less than would be evidenced in child migrants. However, a specific age limit up to which attrition is more likely to occur is undetermined, as is the actual amount of attrition in relation to age effects (please see Section 1.2.2). For this reason, an investigation into the effects of age of arrival is considered to be warranted in the present study.

Another internal extralinguistic predictor variable which has been studied in research into first language attrition is that of length of residence in the L2 environment (LOR) (Schmid, 2002). Specifically, this variable often represents the number of years spent in the migrant community where the L2 is the predominant language. As already noted, age of arrival is often highly correlated with length of residence and in many studies into L2

acquisition in a migrant setting, it is investigated with a level of importance approaching age of arrival (Piske et al., 2001 : p. 197). An intuitive assumption regarding length of residence is that first language attrition will be more likely to occur the longer an individual has lived in the L2 setting. Surprisingly, a linear relationship between L1 attrition and length of residence in an L2 migrant setting has not been found (Schmid, 2002; Köpke and Schmid, 2004). This may be because the effects of length of residence are in part determined by age of arrival: a shorter length of residence in childhood may have a more significant impact on L1 attrition than a longer length of residence in adulthood.

In light of a multicomponential framework, LOR may be connected with language contact, the assumption being that a longer length of residence in the recipient country may promote more L2 and less L1 language contact. However, at least in terms of L2 acquisition of the phonetic domain, it has been proposed that length of residence may be non-linearly correlated with L2 acquisition (Flege and Fletcher, 1992; Piske et al., 2001). It seems that in the early phases of L2 learning “additional experience in the L2 may well lead to less foreign-accented L2 speech”, but that “for highly experienced subjects, additional years of experience in the L2 appear to be unlikely to lead to a significant decrease in degree of L2 foreign accent (Piske et al., 2001 : p. 198). Non-linearity in the effects of length of residence on pronunciation of L2 speech has parallels with the findings that in first language attrition, whether an individual loses aspects of his or her native language is determined during the first years after migration (de Bot and Clyne, 1997). Relating these findings to the present study, it may be expected that the German migrants, who all have a length of residence of 10 years or more, may no longer display length of residence effects, as these would only be evident if a group with a shorter length of residence was comparatively examined. However, given that there was a wide range of LOR in the migrants of the thesis at hand, an analysis of the effects of length of residence was considered to be warranted.

This leads into the next predictor variable, that of language contact. The role of language contact has been briefly explored in the analysis of the Subsystems Hypothesis (Paradis, 2004; Paradis, 2007) which states that “every time an item is activated, its threshold is lowered and fewer impulses are required to reactivate it” (Paradis, 2004 : p. 28). In other words, if an item is not used, its activation threshold becomes higher and its accessibility diminishes. Although the term language use is referred to by Paradis in determining the activation threshold, language contact may also occur more passively in the form of listening or reading, in which the language is not actively used.

The inclusion of language use, or more generally language contact, again emphasises a multicomponential theory of first language attrition. This is because language contact is influenced by both internal and external extralinguistic factors. On the one hand, motiva-

tion, as an internal factor, may influence language use (Paradis, 2007). Highly motivated migrants may wish to maintain more contact with their country of origin, and return regularly. Alternatively, migrants may wish to cut ties with their place and language of origin. Motivation may therefore potentially reflect other more specific sub-variables such as, for example, frequency of L1 reading, and visits to the country of origin. External factors (e.g. the environment to which the migrant is 'exposed to') may also contribute to the amount, and potentially type, of language contact a migrant experiences. An individual who moves to a country in which there is already a large population of migrants from his or her country of origin will have more opportunity to maintain L1 contact, albeit not necessarily with the original L1 source. In this way, language contact as an overall umbrella variable reflects the individual as both contributor and product of his or her environment. Bilinguals may construct environments in which they use and are exposed to more (or less) contact with their native language.

The analysis of language contact in this light emphasises an action-oriented developmental perspective (Brandtstädter, 1993). According to this perspective, a comprehensive analysis of development (and aging) must incorporate not only the cognitive and neurobiological dimension, the social and cultural constraints in which an individual resides, but also the personal or intentional values and actions of the individual (Brandtstädter, 1993 : p. 195). This action-oriented developmental perspective has strong parallels with the call for a multicomponential framework in first language attrition, particularly with regard to the Dynamic Systems Theory (de Bot, 2007), as previously discussed. In relating this perspective to first language attrition, the claim is made that late consecutive bilingual migrants may be active in seeking out particular language settings. The simple fact that lack of contact with the L1 in an L2 migrant setting gives rise to research in first language attrition, to begin with, highlights the role of the individual who moves to a country in which the second language is spoken. In many cases, this is an active and empowering decision on the part of the migrant. In other cases, little choice may be involved. In most analyses of language contact, however, the active role of the individual runs the risk of being understated. Instead, the focus is on how much of a particular language the migrant is 'exposed to'. In relation to an action-oriented developmental perspective, emphasis is placed on the active individual in his or her construction of the environment through increasing or decreasing L1 (and L2) language contact in a migrant setting.

Moreover, it is potentially not only the amount of language contact, but also the type of contact which a migrant maintains with his or her native language which influences language attrition. Several authors mention that quality of contact plays a role in first language attrition (Jaspaert and Kroon, 1989; Cook, 2003; Schmid, 2007a). Jaespert and Kroon (1989) summarized the results from their study of Italian native speakers in the

Netherlands that “practice makes perfect does not hold” (p. 94). The participants in their study who were married to native speakers of Italian actually exhibited *more* native language loss than those who were married to non-native Italian speakers. An explanation for this may be Cook’s suggestion that “the L2 user who is part of a minority in a culture may be socializing with a group of fellow L1 speakers. Over time these isolated L1 communities may evolve their own language” (2003 : p. 14).

Schmid (2007a) differentiated between L1 language contact in a bilingual and in a monolingual mode in her study into first language attrition. This distinction was originally put forth by Grosjean (2001). The monolingual mode is characteristic of communication in which only one of the bilingual’s languages is activated, the other being largely deactivated. In a bilingual mode, both languages are active. Code-mixing may characterise a bilingual mode, for example. A specific finding of Schmid’s investigation was that bilingual migrants who regularly used their L1 (German) for professional purposes (Schmid described this language setting as being a monolingual mode) achieved slightly higher scores in their L1 of German than participants who did not use their German in professional settings. In contrast, native German use with family (allocated to a bilingual mode) was not a significant predictor variable. Schmid (2007a) summarised that “attrition might depend less on the mere frequency to which the L1 is continued to be spoken than had previously been assumed, since quality of contact might be more important than quantity, and more to the fact that monolingual mode use of the L2 demands that the L1 be inhibited” (p. 150). These results regarding both the amount and type of contact migrants have with their native language suggest that an investigation into their impact on L1 attrition in the present study may deliver insightful results.

Aptitude, or the individual ability to learn languages, has also been suggested to influence first language attrition. Those speakers with a high language aptitude may be more likely to acquire an L2, as well as maintain L1 competencies. Carroll (1965) proposed four components which underlie language aptitude in L2 learning: 1. phonemic coding ability, 2. inductive language learning ability, 3. grammatical sensitivity, and 4. associative memory capacity. Particularly the first, phonemic coding ability, is relevant for the study at hand. This component describes the capacity to process new auditory input effectively. In a conversation with Paul Meara, author of the Swansea Language Aptitude Tests, at the University of Swansea in August, 2006, the decision was made not to investigate the impact of phonetic aptitude on first language attrition outcomes due to there being no established tool used to measure this intralinguistic variable (Meara, 2006).

Language attitudes have also been suggested to impact first language attrition. In such analyses, the general assumption is that cultural affiliation coincides with linguistic affiliation. In other words, where an individual strongly identifies with the new country

and language, first language attrition will be more evident. A study by Schmid (2002) showed that the persecution of German Jews in the Second World War generated emotions which influenced the process of attrition. Such internal attitudes, or emotions, on the part of the bilingual migrant (in this case refugees), are obviously related to the conditions of the external environment.

In operationalising language attitude, questions linked with language attitude may be, for example, has the migrant chosen to maintain the citizenship of the country of origin? With which cultural group does the participant identify most, that of the recipient country, or the country of origin? In less extreme settings, not characterised by persecution, studies have been unable to find a correlation between internal attitudinal measurements and linguistic performance (Köpke and Schmid, 2004; Yağmur, 1997). There is a potential for circularity in research into identity and language proficiency. Does affiliation to the new country promote first language attrition, or does first language attrition promote affiliation to the new country? A qualitative study by Prescher (2007), who investigated German native speakers in the Netherlands, suggests that there is a “close relation between language (decline) and identity as a result of interacting factors over the lifespan” (p. 191). Interestingly, she notes a non-linear process of identity finding in the migrants she investigated. Even though a loss of L1 skills was reported in every participant, “the longer the duration of immigration, the stronger the attempt to return to the original identity and language” (p. 201). In other words, first language attrition may also be correlated with an *increased* affiliation to the country of origin.

Level of education has also been noted to correlate with first language attrition, although this variable has received considerably little attention (Köpke and Schmid, 2004). Jaespert and Kroon (1989) reported that “education was the most important explanatory factor for the variability in the results” (p. 92). In their study of Italian migrants in the Netherlands, people with a higher education level were more likely to maintain their L1 language proficiency in a migrant context than people with a low level of education. As pointed out, this may be because level of education is associated with other variables, such as income (Jaspaert and Kroon, 1989). Individuals with a higher income may be able to return home more often and this increase in L1 contact, particularly in a monolingual mode (Schmid, 2007a), may in turn promote L1 maintenance. In a study on Turkish native speakers in Australia by Yağmur et al. (1997), level of education was a specified independent variable. Here it was found that “the education received in the first language plays an important role in the maintenance of that first language” (Yağmur, 1997). In other words, in their study it was not simply a question of how much education was received, but *where* the education was received. Interestingly, they noted that, “a relatively high L2 proficiency level goes together with a relatively high L1 proficiency level” (p. 64), both

associated with level of education. In Yağmur et al.'s (1997) study there was a noted high correlation between length of residence in Australia and level of education, which may have influenced their findings. Köpke (1991, as cited by Köpke and Schmid, 2004) alternatively found that more educated subjects in both her experimental and control groups (regardless of where they were educated) produced the L1 target structures more often. Her results support the general claim by Jaespert and Kroon (1989) that education must be controlled for in studies into first language attrition. This is because L1 proficiency is positively correlated with level of education (even in monolingual speakers). Cook (2003) similarly emphasises the importance of examining level of education because monolingual control speakers may be more likely to have a restricted education level given that in many countries education level is associated with knowledge of other languages.

Little research has been devoted to the relationship between sex of informants and first language attrition. Some researchers have attributed language change to the sex of the informants, although Yağmur (1997) noted that this variable is often confounded with sociolinguistic variables, for example whether it is expected of women that they not work outside the home or have contact with members outside of their own culture. This means that it may not be sex which is influential in affecting first language attrition, but rather gender. Interestingly, this interpretation of the role of sex in determining first language attrition, refers again to the importance of the potentially underlying variable of language contact rather than a biological determinant.

A discussion of the above predictor variables emphasises the uniqueness of individuals in their environment. Intralinguistic and extralinguistic predictor variables characterise participants and may contribute to the process of first language attrition. People, both monolinguals and bilinguals, are dynamic and able to construct their environment as well as take shape from it. In this way the inclusion of predictor variables in an investigation into first language attrition may deliver explanations as to why members of a seemingly homogenous group of bilinguals display different linguistic, and here specifically phonetic, abilities. This is precisely the focus of the research at hand.

1.4 What does this mean for the present study?

The previous sections of this chapter have presented information which form the basis of this thesis. There are a few major points which can be summarised, before moving on. First of all, the specific definition of first language attrition applied in this thesis (the non-pathological, non-age related, structural loss of a first language within a late consecutive bilingual, assuming that the acquisition of the first language precedes its loss) should be

emphasised. The bilingual migrants who participated in this research learned their native language of German in a monolingual environment before moving to either Canada or the Netherlands in late adolescence or adulthood. Loss in this thesis therefore describes change in the native language which occurred after acquisition, as it is assumed that L1 acquisition was complete upon migration. Whether observed first language attrition is evidence of loss at solely the level of performance, or whether an underlying competence is also affected, is an additional question not directly tested. Instead, the focus is on the speech of the late consecutive bilingual migrants in a particular *moment*. Here, the specific moment is that of the investigation. It is this moment which is considered to be representative of other situations experienced by a migrant, characterised by contact with the native language.

The main question of the research is whether a fully acquired L1 phonetic system can change, or be lost, when a second language is acquired in adulthood in a migrant context. The study is cross-sectional in that first language attrition is assumed to have occurred when the phonetic elements under investigation in the experimental group (the migrants) differ from the corresponding phonetic elements in the control group (non-migrant native speakers of German).

In general, conclusions drawn from previous studies into first language attrition within the domain phonetics (rare though they are), emphasise an interactional effect between the L1 and the L2 of late consecutive bilinguals. It has been suggested that L1 loss mirrors L2 acquisition, or that L1 and L2 phonetic systems undergo either merging, or polarisation. Little attention has been given to variation within and between late consecutive bilinguals and it is precisely this which the present investigation aims to do.

Accordingly, what follows is initially an investigation into the *perception* of first language attrition in native speech (Experiment I). The question here is whether a foreign accent is perceived in the native speech of German migrants to Canada or the Netherlands by native speakers of German, resident in Germany. Thereafter, the *production* of selected elements of the L1 and L2 is investigated (Experiment II). Here the objective is to examine whether first language attrition is revealed through an acoustic analysis of segmental and prosodic elements (the lateral phoneme /l/; tonal alignment and pitch range). Intra- and interpersonal variation are explored, as well as the impact of a merging effect between the L1 and the L2 of these phonetic elements.

Finally, the findings of both Experiment I and Experiment II are interpreted with regard to extralinguistic predictor variables, which may help in an explanation of potential differences in first language attrition between bilinguals. The predictor variables of age of arrival, length of residence and amount and type of L1 contact are of particular interest (see Section 1.3.3). The multicomponential nature of these predictor variables, or inter-

dependency, is not overlooked in this interpretation. Theoretical frameworks which have, for the most part, either been constructed based on the results of previous studies into higher linguistic domains (see Section 1.3.1), or with an emphasis on L2 speech acquisition (see Section 1.3.2), may also aid in interpreting the findings of this study. In this way, the study investigates both whether first language attrition in the domain of phonetics occurs, as well as extralinguistic variables which potentially impact its occurrence.

In sum, this means that the present study is a contribution to the relatively new research field of first language attrition through its focus on the domain of phonetics at the perceptual, segmental and prosodic levels of speech. The relationship between perception of foreign accent in native speech and the production of native speech which is deviant from a monolingual norm is of theoretical consequence.

Perhaps more important than its theoretical contribution to the rather new research area of first language attrition, this thesis is potentially of personal relevance to migrants around the world who have moved to a new country in adulthood. Far from being exceptions to the rule, the United Nations estimates that presently almost 200 million persons live outside their country of birth. Of these, many will have acquired a new language as adults in their recipient country. Those migrants who wonder whether their native language pronunciation, as it was acquired from birth onwards, has been impacted since the acquisition of their second language, may find this thesis relevant.

Chapter 2

Experiment I: The perception of foreign accented native speech

2.1 Introduction to Experiment I

In the previous chapter, studies which have investigated the phonetic system of L1 speech in the context of late consecutive bilingualism were explored. As discussed, a particular case-study by Sancier and Fowler (1997) suggested that in a native Brazilian Portuguese speaker, a foreign accent was detected after she had lived in the United States for an extended period of time. To a certain extent this perception of foreign accent in native speech supports other acoustic studies which have detected first language attrition in the production of L1 speech in late consecutive bilinguals (Flege and Hillenbrand, 1984; Flege, 1987; Major, 1992; Mennen, 2004).

Experiment I, which is the focus of Chapter 2, examines whether foreign accented speech is perceived in the native speech of a large group of late consecutive bilinguals. In this way, a particular aspect of Sancier and Fowler's study is expanded upon. More specifically, the primary aim of Experiment I was to examine whether global foreign accent is perceived in the native speech of German migrants who migrated to Canada or the Netherlands. Their native speech was globally assessed for foreign accent by native German speakers in Germany. As already explained, the assessing of a migrant's native German to be non-native, on the basis of his or her pronunciation, was interpreted as evidence for first language attrition.

Given the results of previous acoustic studies into L1 change under the influence of late adult L2 acquisition (Major, 1992; Mennen, 2004), in which variability between bilingual participants was reported, it was predicted that differences would be observed within the migrants with regard to the perception of foreign accent in native speech. Accordingly,

the secondary aim of Experiment I was to examine variability in first language attrition. In relation to this aim, a number of predictions were made.

On the one hand, it was predicted that first language attrition at the level of perception would be more evident in the native speech of the Dutch L2 speakers than in the English L2 speakers. This prediction was made given results from Flege (1987) and Flege and Hillenbrand (1984) which suggest that in similar sounds the pronunciation of the L1 will be affected, whereas dissimilar sounds will be less likely to be affected. If one accepts that German and Dutch are more phonetically similar than German and English (Glück, 1993 : p. 419 and Knowles, 1997 : p. 19), one may therefore predict that this overall similarity will promote more L1 attrition in the Dutch L2 speakers than in the English L2 speakers, the latter of which will be more able to maintain independent phonetic categories in their native German.

Moreover, extralinguistic variables (age of arrival (AOA), length of residence (LOR) and amount and type of contact to the German native language) were investigated in order to determine whether they impacted the degree of perceived foreign accent in native German speech. These predictor variables were chosen given the results of other studies, investigating higher linguistic levels, which have suggested that first language attrition is more likely in migrants who move to their new country at an early age than in those who move at an older age, and that length of residence and native language contact may impact the amount of first language attrition. As will be discussed, multiple regressions were conducted in order to answer this latter question. Given the statistical nature of these tests, it was not possible to investigate all potential predictor variables. For this reason, a choice was made as to which variables would be the most fruitful and only these were investigated in the multiple regressions.

Specifically, based on the information described in Chapter 1, the following hypotheses were therefore tested in Experiment I:

1. Hypothesis: German migrants to Anglophone Canada and the Dutch Netherlands (the experimental groups) will be more likely to be perceived as non-native speakers of their native German language than German native speakers in Germany (the control group);
2. Hypothesis: The amount of L1 attrition in migrants will be influenced by linguistic similarity: speakers with Dutch (more similar to German) as an L2, will display more first language attrition than speakers with English (less similar to German) as an L2;
3. Hypothesis: Variability in the amount of L1 attrition will be influenced by extralin-

guistic variables, such as AOA, LOR and the amount and type of language contact with German.

Experiment I therefore investigated whether first language attrition at the level of perception occurs in the native speech of German migrants to Canada and the Netherlands and whether intralinguistic (English versus Dutch as an L2) and extralinguistic (AOA, LOR and the amount and type of language contact with German) predictor variables were able to predict such first language attrition.

2.1.1 Outline of Experiment I

Initially, the methods used in the experimental design of Experiment I are reported. Both stages of the data collection are examined. The recordings of the migrant speakers and the language background questionnaire were completed prior to the global foreign accent assessment. Within the methodology section, a focus is on a detailed analysis of the migrant speakers. Thereafter, the results of the analysis are reported. In the discussion of the perception experiment, the results are interpreted. At the end of this chapter, the conclusion of Experiment I provides an outlook for Experiment II and relates the results to the information provided in Chapter 1.

2.2 Methodology

2.2.1 Speech samples

The speech samples were extracted from previous recordings of a film retelling task (originally used by Perdue 1993 and Huebner et al., 1992 and described again in Schmid, 2004). In this test, experimental and control participants were asked to retell the silent Charlie Chaplin film *Modern Times*, which they had just seen. This Charlie Chaplin task was part of a larger interview which was conducted on the part of Monika S. Schmid through the support of a NWO Veni grant (275-70-005: Methodological issues in L1 attrition research). The interview started with a questionnaire assessing the language background of the participants. It then progressed with a number of tasks aimed at assessing language proficiency in the following order: matched guise test, C-Test in German, grammaticality judgement test, Wug test, a verbal fluency assessment, Charlie Chaplin test, another Wug test, another verbal fluency assessment, C-Test in the L2 (either English or Dutch), and finally Can-Do scales. The total interview took between 25 and 90 minutes, although some participants took slightly longer in the case that they had a lot to say regarding the

questionnaire. The results from these tests examining language proficiency were not further investigated in the follow-up study, representing Experiment I. This is because the predominant question of Experiment I examined whether a foreign accent is perceived in the speech of the bilingual migrants, and not, for example, whether C-test results are correlated with foreign accented native speech. Such questions do however represent interesting avenues for future research.

From the total film retelling task, the description of two specific scenes were chosen. These were the scenes in which the bread is stolen, and in which the police arrest the main character of the story. Consequently, semi-spontaneous speech was elicited. This avoided the effect of listeners judging “a set of non-native produced sentences to be more strongly accented after, as compared to before, they became familiar with those sentences” (Flege and Fletcher, 1992 : p. 370) because although speakers’ utterances focused on the same occurrence in the Charlie Chaplin film, they were not predefined. The speakers therefore used similar vocabulary, since the same incident in the film was retold, but did not repeat the same utterance.

Recordings were made in the participants’ homes in a quiet setting where background noise was not evident. This environment facilitated the German listeners’ assessment of native or non-native speaker status. In other words, their assessments were not influenced by the quality of the recordings. Monika S. Schmid contacted the participants through initially writing to the embassies for addresses of German organisations in Canada and the Netherlands. She also placed adverts in German newspapers in Canada and the Netherlands. The migrants then contacted her and appointments were made for the interviews.

More participants were recorded than were included in Experiment I. Not all participants from the original recordings were included in Experiment I because some participants did not mention the specified scenes. Also, some participants’ speech contained grammatical errors which would have meant that the listeners could have assessed their speech to be foreign accented on the basis of grammaticality rather than on pronunciation. Of the total 56 English L2 speakers, 34 were used in Experiment I and of the total 56 Dutch L2 speakers, 23 were included.

The speech samples varied in duration from 12.6 to 17.7 seconds (average 15.2), depending on where the speech sample was cut from the total recording of the retelling task. The decision to edit at a certain point was based on the subjective interpretation that an utterance had come to an end, although in spontaneous speech this is difficult, if not impossible, to determine. No speakers were interrupted during their train of speech and this accounted for the variance in total duration of each speakers’ recording. The speech samples had a similar peak intensity, meaning that the speakers spoke similarly loudly. Furthermore, silent pauses which exceeded one second in duration were reduced to one

second.

The 15.2 second average duration of recordings was expected to be sufficient to allow the listeners to judge level of foreign accent in the native speech of both the migrant groups and the control group. Flege (1984), for example, found that short phrases, consonant vowel sequences, and even 30 milliseconds from truncated ‘/t/-bursts’ (stimuli including the burst, frication, and a variable portion of the aspiration filled interval following stop release) can be sufficient for native speakers of American English to make a reasonably accurate decision as to whether a token is produced by a native or non-native speaker (when previously instrumentally measured).

Furthermore, it was ensured that the isolated segments contained no grammatical or lexical errors. This prevented listeners from being influenced in their assessment of foreign accent by the presence of non-target like utterances. The classification of the speech segments as being grammatically and lexically correct was verified after the experiment, when listeners were asked on an informal basis to describe what they had based their judgements on and neither grammatical nor lexical errors were mentioned. On the other hand, although not considered ‘errors’, it is possible that lexical and grammatical diversity may have influenced the listeners’ ratings. At the end of the listening sessions, when listeners were asked to mention what they had based their ratings on, one listener mentioned word choice. More specifically, he said that he knew that a certain speaker was a German native speaker because she used the term ‘*grüne Minna*’ (in English, black Maria, or paddy wagon), which was only used once in all of the recordings, and that “only a native speaker knows a word like that”. Surprisingly, the speaker who he was referring to was not clearly classified as being a native speaker on average, so the use of this term may not have influenced all listeners’ decisions. All the same, it seems feasible that lexical and grammatical diversity may have influenced some listeners’ assessments, although as already discussed, the alternative of having speakers repeat a predefined utterance may also have had its drawbacks.

2.2.2 Procedure

The global foreign accent assessment, which was used to assess the speakers, was adapted from Moyer’s (1999) global foreign accent assessment of German second language learners. Before the foreign accent assessment commenced, the listeners who assessed the speech samples filled in a brief self-assessment (please see Section 2.2.5). Once this was finished, the foreign accent assessment began. In this forced choice paradigm, judgements were invited from German monolingual listeners, resident in Germany. For each recording the listeners were played, they were invited to make two judgements. From these

judgements, FAR (foreign accent rating) was calculated. The first judgement consisted of determining native versus non-native speaker status, the second judgement reflected the listener's confidence level on a three-point scale. This resulted in an operative six-point Likert scale: 6=certain of non-native speaker status, 5=semi-certain of non-native speaker status, 4=uncertain of non-native speaker status, 3=uncertain of native speaker status, 2=semi-certain of native speaker status, 1=certain of native speaker status. A speaker with a low FAR (i.e. who was perceived as native or near-native) was assumed to have a low to non-existent foreign accent. This was interpreted as representing lack of first language attrition, or L1 maintenance. Alternatively, a speaker with a high FAR (i.e. who tended to be perceived as non-native) was assumed to have a stronger foreign accent. This was interpreted as an indication of first language attrition. For example, if a speaker received a rating of six on the scale (certain of non-native speaker status), this was interpreted to be the highest FAR, or the most foreign accented native speech (i.e. suggesting first language attrition). Similarly, a rating of one on the scale (certain of native speaker status) represented the least, (or non-) foreign accented native speech (i.e. not suggesting first language attrition). The relative polarity of the extreme values on either end of this scale in relation to the intermediate values is given further attention at the end of this chapter.

A period of silence with a duration of seven seconds followed each recording, which was played only once. This period of silence was deemed long enough to cover the answering of the assessment, while allowing for the total duration of the experiment to remain compact. In other words, each speaker was played once. During the period of silence, German listeners completed the global foreign accent assessment for the speaker they had just heard, prior to the silence. After the period of silence, the next recording was presented, followed by the next seven second period of silence, in which again the global foreign accent assessment was completed for the speaker they had heard directly prior to the pause. This process continued for all speakers. The total duration of the sequence of recordings, including pauses, was 22.53 minutes.

2.2.3 Experimental speakers

The experimental groups consisted of 34 German native speakers who had moved to Canada and 23 who had moved to the Netherlands. As already specified, a single speech sample of each speaker, including the control group (refer to the following section for more information on the control group) was rated using the global foreign accent assessment described above.

Before the original recording of the Charlie Chaplin film retelling task, each speaker

was invited to fill in a questionnaire. This questionnaire was intended to examine the speakers' sociolinguistic background and was part of a larger study into first language attrition investigating more specifically syntactic and morphological elements of language. The original version of this questionnaire can be found in (Schmid, 2002). Only a part of this original questionnaire was examined in the present study.

The present section describes information gathered from this questionnaire. The experimental speakers who were recorded had all moved to either Canada or the Netherlands in adolescence or adulthood. Some migrants had knowledge of their second language while living in Germany, but none had been in an immersion setting prior to migration. This similarly applied to additional languages. Some speakers had knowledge of additional languages, such as French and Russian, but none had been exposed to these languages in an immersion setting either prior to or post migration. As already discussed in Chapter 1, the speakers were therefore late consecutive bilinguals whose native language of German was fully and solely acquired in childhood and adolescence, after which the acquisition of either English or Dutch occurred.

Almost all experimental speakers had been born in Germany, aside from two individuals who were born in East Prussia, one individual who was born in West Prussia, and one individual who was born in what is now Serbia. These individuals were born into German speaking families and grew up in German speaking communities. Their families fled to Germany after the Second World War, when they were young children, and they were henceforth raised in Germany. None of these participants mentioned in their questionnaire that the German regional accent of their place of birth influenced their present pronunciation.

It should be noted that in the original recording sessions, regional accent was not examined in detail because the study's initial focus was not on speech. Based on a yes-no self-assessment in the questionnaire (e.g. 'Do you speak a German dialect? If so which?'), there were two subcategories: speakers who assessed themselves to have a regional accent ($n=20$) and those who did not ($n=37$). An independent t-test with the dependent variable of FAR revealed no significant difference between the regionally accented and the non-regionally accented groups. This result ensured that differences in FAR were in fact attributable to foreign rather than regionally accented speech. All the same, regional accent may have influenced the listeners' ratings and this potential impact is approached in the discussion of this chapter.

The consecutive bilinguals also noted their AOA (age of arrival) to Canada or the Netherlands and their LOR (length of residence). This data is summarised in Table 2.1. In independent t-tests, AOA proved to be significantly different between the Canadian and the Dutch groups. Those who moved to Canada did so at a significantly younger

age than those who moved to the Netherlands ($t(55) = 2.75; p < .05$). There was no significant difference between the LOR of the German migrants in Canada and those in the Netherlands, suggesting that the Dutch L2 group was slightly older than the English L2 group, although this difference was also not significant. The effects of AOA on the two L2 groups is examined in the results.

L2 Group	Average	Stdev	Maximum	Minimum
AOA English L2	25	6.4	40	14
AOA Dutch L2	30	9.6	51	16
LOR English L2	38	12.1	54	9
LOR Dutch L2	34	13.3	58	16
AAR English L2	64	10.4	88	37
AAR Dutch L2	64	9.5	85	39

Table 2.1: The average age of arrival (AOA), length of residence (LOR) and age at recording (AAR) of German migrants to Canada and the Netherlands in years. The standard deviation (Stdev), as well as the maximum and minimum AOA, LOR, and AAR are also displayed. AOA differs significantly between the two L2 groups whereas LOR and AAR do not.

Although the sample size was too small to include education of participants as a predictor variable in the multiple regressions (as well as numerous other possible predictor variables), it was ensured that a similar level of education was evident across L2 and control groups. As previously discussed in Section 1.3.3, this was done because some research suggests that first language attrition is more likely to occur in bilinguals with less official education than in those with tertiary education (Yağmur et al., 1999; Jaspaert and Kroon, 1989). Based on the language background questionnaire, level of education was classified by way of a four-level taxonomy: Level 1 comprised those participants who had completed the lowest level of German formal education, *Volksschule* or *Hauptschule*. Level 2 were those participants who had completed intermediate schooling, *Realschule* or *Mittlere Reife*. Level 3 comprised those participants who had completed 13 years of schooling (*Abitur* or *Fachabitur*), which is the prerequisite for entrance to higher education, but had not gone on to that kind of study. Level 4 were participants who had acquired a tertiary level of education. A Chi-Square Test was performed in order to determine whether the three groups differed in level of education. Unfortunately, six cells in this analysis had a count less than five, violating an assumption of Chi-Square tests. This was due, on the one hand, to a small control group, and on the other hand to a four-way education classification. In order to compensate for this problem, Level 3 and 4 were grouped together. As such, only three cells violated the Chi-Square test assumption (Dutch L2, Level 1; German control, Level 1; German control, Level 2). The results of

this analysis were not significant, which suggested that there was no association between level of education and language ($p > .10$). Moreover, when the control group was not included, resulting in only one cell which violated the assumption, there was even less association ($p > .50$). A summary of the original cross-tabulations is reported in Table 2.2.

Level of education	Control Group		L2 English		L2 Dutch	
	n	%	n	%	n	%
Level 1	3	60.0	8	23.5	3	13.0
Level 2	2	40.0	16	47.1	11	47.8
Level 3	0	0.0	3	8.8	2	8.7
Level 4	0	0.0	7	20.6	7	30.4

Table 2.2: The level of education of each group in Experiment I. Level 1 is the lowest level of education, Level 4 is the highest level. There was no significant association between level of education and group.

In other words, it stands to reason that because groups did not significantly differ regarding level of education, potential differences in FAR may not be attributed to a difference in level of education across the groups.

The absolute and relative amounts of males and females within each group may be observed in Table 2.3. Most research indicates that the sex of an individual in itself is not related to language attrition, but rather the cultural context in which one lives. Where women are encouraged to maintain strong links with the original culture, and not have ties outside their own culture, it may be expected that they exhibit less first language attrition (Yağmur, 1997). In Table 2.3 in can be seen that there was an overall equal balance of males and females.

Group	Male		Female	
	n	%	n	%
L2 English Group	12	35.3	22	64.7
L2 Dutch Group	5	21.7	18	78.3
Control Group	3	60.0	2	40.0

Table 2.3: The amount of males and females in each group.

For now, it is of relevance to summarise that within the experimental subjects at hand, differences were found with regard to AOA in Canada or the Netherlands, but not with regard to the other variables. Instead, the groups resembled one another in terms of LOR, education and sex. When looking ahead to the results, the role AOA and LOR play in influencing first language attrition will be explored.

Language contact

A number of background variables pertaining to language contact, use and environment were gathered through the original questionnaire for each speaker. All questions were on a five-point Likert scale, which was later converted to an interval variable between 0 and 1. For each variable, 0 referred to no use or presence of the L1 in that particular type of situation, while 1 referred to extremely frequent use or presence of the L1. The impact of this contact variable was explored in two steps.

In the first analysis, the variable CONTACT was an average composed of the following subvariables: 1. amount of contact with German at work; 2. amount of German spoken with present partner; 3. frequency of visits to Germany since migration; and 4. overall estimate of amount of contact with German. In other words, a single variable was calculated for each speaker, which was derived from these subvariables. Similar to the subvariables, the overall variable was between 0 and 1. In independent t-tests, only frequency of visits to Germany proved to differ significantly between the two groups ($t(55) = -5.45, p < .001$). Given the geographical proximity of the Netherlands to Germany on the one hand, and the distance of Canada from Germany on the other, this difference is not surprising. The fact that the averaged variable CONTACT was not significant suggests that German migrants to Canada compensated for a lack of visits through alternative means.

As will be discussed, the results from the initial analysis of contact indicated that quantity of L1 contact influences the amount of attrition a migrant in an L2 setting undergoes. These findings prompted a second, more detailed, analysis of contact, in which both quantity and quality of contact were investigated more closely. Due to the fact that there are numerous ways for a migrant to maintain or lose contact with his or her native language, two different types of contact were differentiated. Both frequency of contact with the German L1 in communication settings conducive to code-mixing and/or code-switching (C+M), as well as frequency of contact with the German L1 in settings in which mixing and/or switching are less likely to occur (C-M) were investigated in relation to their impact on first language attrition, or here foreign accented native speech.

The contact variable in which code-mixing and/or code switching was likely to occur (C+M) was an overall average of three variables:

- FAMILY (frequency of L1 use with all family members in Canada or the Netherlands, including children and grandchildren),
- FRIENDS (frequency of L1 use with friends, predominant first language of friends in Canada or the Netherlands),

- CHURCH (frequency of L1 use at church in Canada or the Netherlands).

The contact variable in which code-mixing and/or code switching was not likely to occur (C-M) was also an overall average of three variables:

- WORK (frequency of L1 use at work, for example in the case of translators, German teachers and employees at consulates or embassies),
- VISIT (frequency of visits to Germany per year),
- PHONE (frequency of contact to L1 through telephone conversations and written correspondence to Germany).

It should be specified that the bilingual participants were not asked directly in the questionnaire whether they code-mixed or code-switched in the specified settings. Instead, the participants described the frequency of contact they had with their native language through particular predetermined communication settings, such as at work or with family. It was then postulated *ex post facto* that within these various communication settings or domains (Fishman, 1965), code-mixing was more or less likely to occur. For example, it was possible for a bilingual migrant to be exposed to German through his or her family in Canada or the Netherlands, but to have a circle of friends in which the second language was predominantly used.

The averaged variables C+M and C-M, which are displayed in Table 2.4, were not significantly different for the two groups. This again suggests that German migrants to Canada compensated for a lesser amount of visits to Germany through alternative means.

Type of contact	L2 English		L2 Dutch	
	Mean	Stdev	Mean	Stdev
C+M	0.36	0.26	0.40	0.28
FAMILY	0.39	0.28	0.39	0.33
FRIENDS	0.28	0.29	0.34	0.27
CHURCH	0.47	0.40	0.52	0.44
C-M	0.47	0.18	0.55	0.19
WORK	0.22	0.32	0.31	0.34
VISIT	0.36	0.18	0.64	0.21
PHONE	0.79	0.24	0.65	0.30

Table 2.4: The type and amount of contact migrants of each L2 group had with their native German language. C+M represents contact with L1 in settings where code-mixing and/or switching was considered to be likely, whereas C-M represents contact with German in settings where code-mixing and/or switching was considered to be unlikely.

2.2.4 Control speakers

The questionnaire for the control participants was similar to that of the experimental participants, but did not investigate factors related to migration. Five German monolinguals, two male and three female, who were inhabitants of Germany and had never lived in a foreign country, were chosen to represent the control group. These individuals rarely used languages other than German in their daily lives and described themselves as being German monolinguals. Four of these participants noted in their questionnaire that no regional accent influenced the pronunciation of their German speech. Only one control speaker mentioned that a German regional accent influenced his pronunciation. As already discussed, the level of education was not significantly associated with the control group. Although females and males were distributed evenly within the experimental groups, in the control group there were relatively more males than females. This is unfortunate, although as already described, most research indicates that the sex of an individual in itself is not related to language attrition. The average age at time of recording within the control groups was 61 years of age. The youngest control subject was 53 years of age and the oldest control subject was 65 years of age at the time of recording. In other words, it is assumed that the control subjects represented a small population similar to that of the experimental group, aside from the fact that they had not emigrated from Germany to an L2 speaking environment.

2.2.5 Listeners

Two groups of German listeners completed the foreign accent assessment in two separate sessions. The assessment was conducted in two separate sessions simply to achieve a greater number of listeners. There was no difference between the way the experiment was conducted in the two sessions.

Before the foreign accent assessment commenced, the listeners filled in a brief self-assessment. The aim of this assessment was to control for a minimal to non-existent knowledge of both English and Dutch, since Flege et al. (1992, 1997) suggest that increased exposure to a specific foreign accent is associated with a listeners' perception of the degree of accentedness for a speaker. Because English is taught at an early school age in Germany, contact with the English language in childhood could not be entirely prevented. Similarly, due to the geographical proximity of the Netherlands to the city of Trier, which is in the South West of Germany, exposure to the Dutch language could not be entirely prevented. Listeners who had been extensively exposed to either English or Dutch, for example through a school or university exchange to an Anglophone or Dutch

speaking country, were omitted. Listeners who described themselves as being bilingual with any language combination were also omitted from the analysis.

The results of 10 listeners from the first session and 9 listeners from the second session were included in the analysis. These 19 German listeners were students in early adulthood at the Department of Phonetics at the University of Trier, Germany. They ranged in level of phonetic training from being at the beginning of their studies to the final stages. Some research suggests that phonetic training can improve an individual's ability to detect foreign accent (Piske et al., 2001; Flege and Fletcher, 1992). Due to this training, listeners were considered to be potentially more adept at detecting foreign accent than monolingual German native speakers with no phonetic training.

Inter-rater reliability was excellent, with a Cronbach alpha coefficient of 0.94, indicating homogeneity within the ratings. This verifies that each individual rating was in fact representative of the listeners' ratings as a group.

2.3 Results

Again, the primary aim of this study was to determine whether native speakers of German living in either Anglophone Canada or the Dutch Netherlands are perceived to have a global foreign accent in their native German speech.

As previously described, the foreign accent rating (FAR) was calculated from the operative six-point Likert scale, assessing native or non-native speaker status. For example, if a participant had received a rating of 6 on the operative six-point Likert scale (certain of non-native speaker status), this was interpreted to be the highest FAR: in other words, the most foreign accented native speech. Similarly, a rating of 1 on the scale (certain of native speaker status) represented the least, or non, foreign accented native speech.

Histograms of each L2 group, as well as the control group, can be viewed in Figures 2.1, 2.2 and 2.3. As is evident, due to the fact that the data were positively skewed and that kurtosis across the groups varied, a Mann-Whitney test was conducted in order to investigate the primary aim of the study. Each averaged FAR for the experimental group ($n_{EG}=57$) was compared to each averaged FAR of the control group ($n_{CG}=5$). The late consecutive bilinguals received a median FAR of 3.2, whereas the control group received a median FAR of 1.6. This difference was revealed to be significant at the 5 % level ($U = 57.00, p < .05, r = -.28$), indicating that the German listeners were more likely to perceive migrants in Canada and the Netherlands to have a global foreign accent in L1 speech than the monolingual German controls.

Not all bilingual migrants were evaluated to have a global foreign accent in their native

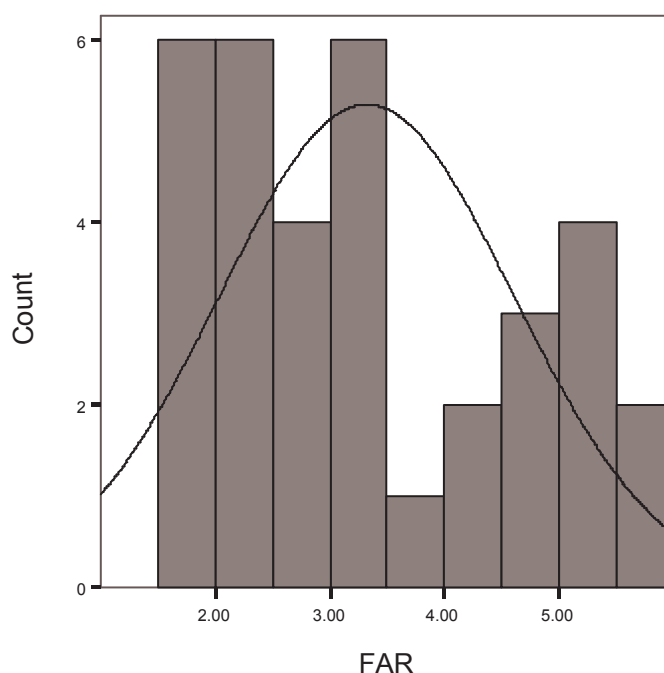


Figure 2.1: Histogram of FAR of German migrants with English L2.

German speech. Twenty bilinguals were rated clearly to be native speakers ($2.5 \geq \text{FAR} \geq 1.0$) (Group 1) and 23 had an unclear FAR ($4.5 > \text{FAR} > 2.5$). However, 14 bilinguals were rated clearly to be non-native speakers of German ($6.0 \geq \text{FAR} \geq 4.5$) (Group 2). Group 1 had an average FAR of 1.9, whereas Group 2 had an average FAR of 5.3 and comprised 9 English L2 speakers and 5 Dutch L2 speakers.

The second aim of this study was to determine whether Dutch L2 speakers displayed more first language attrition than English L2 speakers. The L2 English speakers' FAR was not significantly different from the L2 Dutch speakers' FAR (median=3.14 vs. 3.16, respectively). This was verified by a Mann-Whitney test between the averaged FARs of the two second language groups ($U = 362.50, p = .643$).

Forced entry multiple regression analyses were carried out in an attempt to determine the influence of various predictor variables in the German listeners' evaluations of the bilingual migrants. For all of the regressions, standard assumptions were met, unless otherwise noted (Field, 2005). The first regression tested the impact of the predictor variables AOA, LOR, and CONTACT, on the outcome variable of FAR for the English L2 group ($n_{EL2}=34$). This model was significant with a total adjusted R^2 of .22 ($p < .05$). AOA was the only significant predictor variable with a standardized beta value of -.39 (p

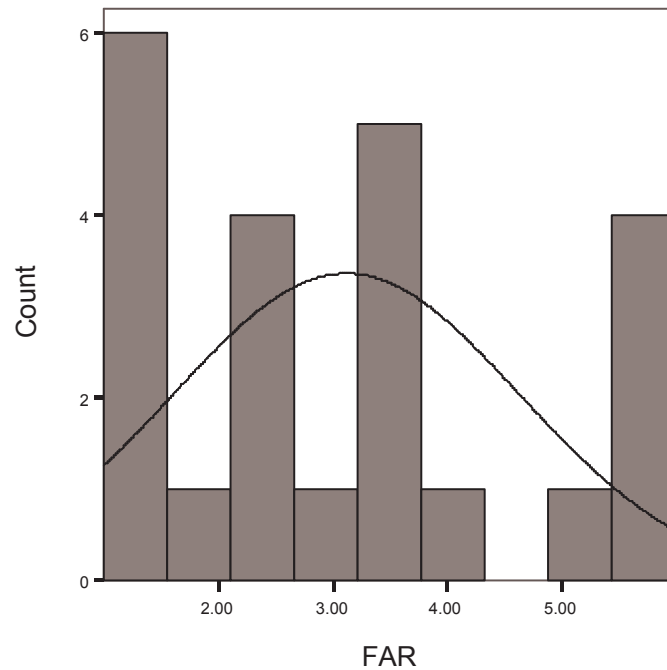


Figure 2.2: Histogram of FAR of German migrants with Dutch L2.

< .05). This means there was an inverse correlation between AOA and FAR: the earlier experimental subjects moved to Canada, the more likely they were to be perceived as non-native speakers. It should be noted that there was a significant correlation between AOA and CONTACT, as well as between AOA and LOR; although the coefficients for both were small ($R=.337$, $p < .05$; and $R = .516$, $p < .05$, respectively).

Another multiple regression was conducted to assess the impact of the same predictor variables on the FAR for the Dutch L2 group ($n_{DL2}=23$), although this sample was smaller than desirable given the amount of predictors. This model was significant with a total adjusted R^2 of .48 ($p < .001$). CONTACT was the only significant predictor variable with a standardized beta value of $-.76$ ($p < .001$). Here again there was an inverse correlation between CONTACT and FAR: the less contact migrants had with their native German language, the more likely they were to be perceived as non-native speakers. AOA correlated here only with LOR ($R=.694$, $p < .001$).

Given the fact that AOA differed significantly between the English L2 and Dutch L2 groups, as explained in the methods section, the question was posed whether AOA would decrease in significance, and CONTACT increase in significance, in an English L2 group with an older AOA. Participants who had immigrated to Canada when they were older

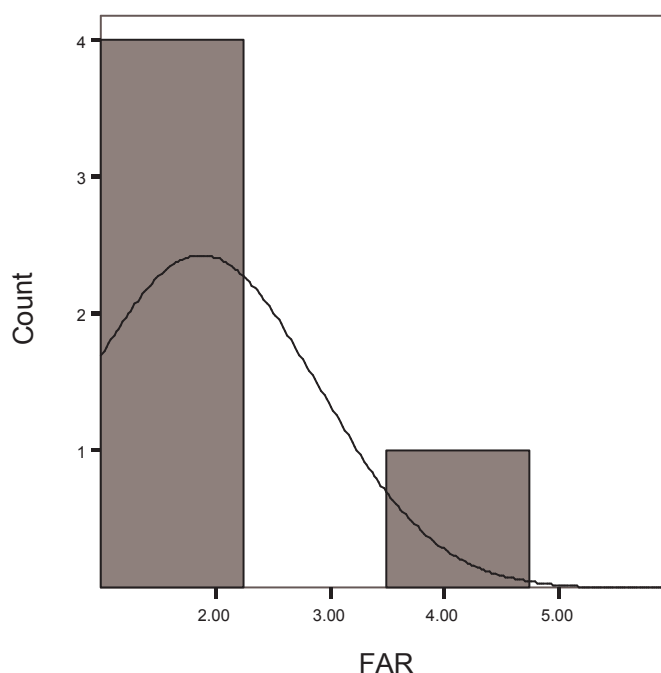


Figure 2.3: Histogram of FAR of German control group.

than 22 years of age were selected for this multiple regression ($n_{EL22}=20$), creating an average AOA of 29 years. Only AOA and CONTACT were entered as predictor variables due to both the small sample and the results of the previous regressions, indicating that LOR was not successful at predicting FAR. This model proved to be significant (Adjusted $R^2=.227$, $p < .05$). CONTACT became the only significant predictor variable, with a standardized beta value of $-.528$ ($p < .05$). This finding indicated that more contact with German was correlated with a lower FAR. In other words, English L2 participants (who emigrated from Germany after 22 years of age) who had more contact with their native language, were less likely to be perceived as non-native speakers of German. No correlation between AOA and CONTACT was evident.

In a final multiple regression, 39 Dutch L2 and English L2 participants who had migrated after the age of 22 were grouped together. This was done on the one hand to increase the amount of data going into the analysis, and on the other hand because in the previous analyses, the L2 language groups displayed similar results. It was therefore thought that they could be analysed as a single group. Both CONTACT and AOA were entered as predictor variables, again because LOR proved to be unsuccessful at predicting FAR. This model was highly significant (Adjusted $R^2=.422$, $p < .001$) and CONTACT was the only

significant predictor variable with a standardized beta value of $-.676$ ($p < .001$). No correlation between AOA and CONTACT was evident in this regression. This final regression suggested that in migrants of both second language groups who emigrated from Germany in early adulthood, the less contact participants had with their native German language, the more likely they were to be perceived as having foreign accented native speech.

2.3.1 Quality of language contact

As already described, due to the fact that CONTACT had a significant impact on first language attrition, it was decided to investigate this variable in greater detail. In doing so, the first regression tested the impact of the predictor variables AOA, LOR, C-M and C+M on the outcome variable FAR for both second language groups ($n_{EG}=57$). This model was significant with a total adjusted R^2 of $.12$ ($p < .05$). The variable C-M was the only significant predictor variable, with a standardized beta value of $-.307$ ($p < .05$). This means that there was an inverse correlation between C-M and FAR: participants who maintained high amounts of contact with German in which little code-mixing was present were more likely to receive a low FAR, hence be perceived as native German speakers. However, significant correlations were evident in this regression, with the most obvious being between AOA and LOR, ($R=-.616$, $p < .01$) and between C-M and C+M ($R=.558$, $p < .001$), indicating that, although differentiated here, there was a positive relationship between the different types of contact. To see whether the effect of C-M would be more clear for migrants who had departed from Germany at an older age, hence after the age of 22 ($n_{EG>22}=39$), AOA, C-M and C+M were entered into a further multiple regression. LOR was not entered because it had been the least successful at predicting FAR in the previous analyses. This model was highly significant with a total adjusted R^2 of $.316$ ($p < .001$) and C-M was again the only significant predictor variable with a standardized beta value of $-.471$ ($p < .01$). This analysis confirmed the previous finding that C-M and FAR were inversely correlated. In other words, speakers who maintained high amounts of contact with German in settings in which little code-mixing occurred were more likely to be perceived as native German speakers. On the other hand, speakers who did not maintain such contact were more likely to be perceived as non-native speakers of German. Again, there was a significant correlation between C-M and C+M ($R=.448$, $p < .05$), as well as between C+M and AOA ($R=.311$, $p < .05$), although there was no correlation between C-M and AOA.

The averaged predictor variable C-M was then broken down and its subvariables were entered into a final multiple regression ($n_{EG}=57$). Here, the model was significant (Adjusted $R^2=.187$, $p < .01$) with PHONE being the only significant predictor variable (stan-

standardized beta value of $-.317$ ($p < .05$)), although WORK approached significance. In this model, none of the predictor variables correlated with one another. The question was then asked whether the subvariables of C-M would achieve greater significance in the subgroup of bilinguals who moved (to either Canada or the Netherlands) after the age of 22 ($n_{EG>22}=39$). This was the case. Again, none of the predictor variables correlated with one another and the model was highly significant (adjusted $R^2=.410$ ($p < .0001$)). Both WORK with a standardized beta value of $-.305$ ($p < .05$) and PHONE with a standardized beta value of $-.551$ ($p < .001$) were significant. This is to say that the more contact migrants had with their native language through work and telephone conversations and written communication to Germany, the less likely they were to be perceived as non-native speakers of German. Finally, when the subvariables of C+M were broken down and entered on their own in a multiple regression ($n_{EG}=57$, the model itself was significant, albeit less than for C-M (Adjusted $R^2=.096$, $p < .05$), but none of the subvariables on their own were significant. When this regression was repeated including only bilinguals who immigrated after the age of 22, the model was no longer significant.

2.4 Discussion of perception experiment

The main finding from this investigation was that some late consecutive bilingual migrants were perceived to have a foreign accent in their native speech. This finding was in line with Sancier and Fowler's (1997) study which revealed that native Brazilian Portuguese judges reported a foreign accent in the pronunciation of a native Brazilian Portuguese speaker after her extended sojourn in the United States. To a certain extent, the findings were also consistent with previous studies which suggest that specific phonetic elements of a native language system may be susceptible to first language attrition within the production of speech, even in adult second language learners (Flege, 1987; Major, 1992; Sancier and Fowler, 1997; Mennen, 2004). However, as will be discussed, the relationship between perception and production of foreign "accent" may deserve further investigation.

The second question which this study addressed was whether perceived foreign accent in native German speech was dependent on the L2 (English or Dutch). No significant difference was revealed between the FAR of English L2 and Dutch L2 speakers. Still, further research may indicate that different second languages do have different effects on the same native language. Moreover, future studies with larger sample groups may substantiate the speculation that it is more difficult for listeners to differentiate between regionally accented and foreign accented speech when languages are used whose dialect

borders overlap, as is the case for the Netherlands and Germany. In other words, it may be that in the present study, potentially Dutch foreign accented speech was misinterpreted as German regionally accented speech. When German listeners were asked to describe what they had based their native versus non-native speaker judgements on at the end of the listening session, some responded that they had difficulties differentiating between regionally accented and foreign accented speech. One listener even specified that this was particularly with reference to speakers from Northern Germany, hence speakers of Low Germanic dialects which, like Standard Dutch, were not affected by the historical High German Consonant Shift. Of the bilinguals in the experimental group who described themselves to be representative speakers of a regional accent, only one subject noted his regional accent to be influenced by a Low Germanic dialect. Accordingly, the comments made by this particular listener suggests that some potentially foreign accented speech may have been misinterpreted to be regionally accented speech, or *vice versa*. However, although this is something to be aware of in future studies, no significant difference between speakers with English and those with Dutch as an L2 was found in the present study - neither group was more likely to be perceived as non-native speakers of German. Still, future studies may prefer to choose languages in which dialect borders do not overlap. More explicitly, this is to say that differentiating between similar phenomena may be more difficult than between non-similar phenomena. In this way, although similar phenomena may be more likely to undergo L1 attrition, they may not be detected by native speakers. As will be discussed in the conclusion of this chapter, this may, in fact, be a fundamental difficulty when investigating whether similarity of languages is associated with attrition.

With regard to regional accent, there was also the possibility that German monolingual listeners, although they had some phonetic training, were less able to distinguish between foreign accented and non-foreign accented speech in regional accents varying from that of their own. This might have resulted in the overall tendency for German bilinguals with a strong regional accent which differed from the regional accent of the listeners to be less accurately assessed than German bilinguals who were representative speakers of either Standard German or of a regional accent familiar to the listeners. Although not direct evidence against the claim that such regionally accented speech may have been less accurately assessed, it is worth emphasising that the difference in FAR between experimental speakers who described themselves as having a regional accent in their native German speech and those who did not was not significant. Nevertheless, in future studies it would be beneficial to control for the regional accent of the listener group by ensuring that their regional accents overlapped with the regional accents of the speakers. This could be controlled for by conducting the foreign accent assessment at different locations in Germany,

thereby ensuring that listeners representing various regional accents were presented with a broad array of German regional accents. In such a way, it could be verified that the significantly higher FAR of the experimental group was not determined to some degree by a less accurate assessment of unfamiliar regionally accented speech.

Continuing, a further aspect of this study investigated the impact of AOA, LOR, and contact on the outcome variable of FAR. In the first analysis, the initial finding was that in the English L2 group, the earlier experimental participants moved to Canada, the more likely they were to be perceived as non-native speakers. In a further analysis of both L2 groups, the results suggested that in migrant populations with a late AOA (here only those who moved after 22 years of age), the effects of contact with the native language became more substantial, whereas AOA and LOR were not significant. In essence, this is to say that in migrants who emigrated from Germany at a later age, those who had more contact with their native language, were less likely to be perceived as having a foreign accent in their native speech than migrants who had less contact with their native language.

A further analysis differentiated between two types of contact. In this way, not only quantity but also quality of contact were examined. On the one hand, the variable C-M represented communicative settings in which little code-mixing between the L1 and L2 was expected to occur, for example in formal, professional settings or in telephone conversations with friends and family in Germany. On the other hand, the variable C+M represented communicative settings in which code-mixing was thought to be more likely to occur, such as with family or friends in Canada or the Netherlands. Admittedly, the categorisation of specific subvariables to settings either characteristic or non-characteristic of code-mixing can be debated. One could argue, for example, that some migrants actively prohibit language mixing in their family, or that in some professional settings, mixing may occur quite frequently. Attention could also be drawn to the potentially different effects of intrasentential versus intersentential code-switching, which the present categorisation does not account for. It is presumptively intrasentential code-switching which might have a greater effect on pronunciation. Nevertheless, for the purpose of this investigation, generalizations were made and the results revealed that across the entire AOA range, the variable C-M was successful at predicting foreign accented native speech, whereas C+M was not. In other words, German native speakers with both English and Dutch as an L2 who had a high amount of L1 contact in settings in which code-switching was *not* expected to occur were *less* likely to be perceived as non-native speakers in their L1 than those migrants who had less L1 contact in such settings. Moreover, the effects of C-M were more substantial in migrants who departed from Germany at a later age, after the age of 22. It was furthermore assessed to what degree the individual variables that had gone into the calculation of C-M were responsible for the overall effect. Here it was established

that L1 use at work and contact with speakers in Germany (for example through telephone conversations) were significant, while the frequency of visits to Germany played no significant role. Again, these predictor variables were more significant in migrants who had departed from Germany after the age of 22.

The fact that VISIT did not come up as a significant predictor variable for FAR is surprising, especially because this was the only factor among all variables which describes L1 exposure in everyday life where there was a significant difference between the two migrant groups. There are several possible explanations for this. Firstly, the variable includes only the number of visits, not the total duration of the visits. Given the expense associated with visits to Germany from Canada on the one hand, and the ease with which a visit from the Netherlands to Germany can be accomplished on the other (a car journey from the region where the interviews took place to the German border will take less than two hours on average), it is possible that the Canadians, while visiting less frequently, went for longer periods of time. This might indicate that a longer sojourn is necessary for the effect on pronunciation to become noticeable, which would be in line with the findings of Sancier and Fowler (1997), who report that the pronunciation of their subject became more native-like after a stay in Brazil of “several months” (1997 : p. 421). Furthermore, the reported amount of contact with L1 (for example through telephone conversations) is slightly, though not significantly, higher for the Canadian group, so it is possible that the lack of exposure through visits was compensated to some degree in this manner. On the other hand, it is possible that the effects achieved by each visit are temporary, and that after a certain time back in the recipient country, foreign accent sets in again. This would suggest that, in order to achieve a long-term effect, contact needs to be more frequent than even the several times per year that the Dutch group returns to Germany on average.

In summary, the results of Experiment I indicate that contact with one’s native language through communicative settings in which code-switching is inhibited may aid in maintaining the stability of native language pronunciation in late consecutive bilingual migrants - at least at the level of perception of foreign accent in native speech. Conversely, contact with one’s native language through communicative settings in which code-switching is allowed, or activated, does not contribute to maintaining the stability of native language pronunciation in consecutive bilinguals.

The analogy of these findings to monolingual and bilingual modes (Grosjean, 2001) does not go unnoticed. Lack of code-switching in conversation can be compared to contact in a monolingual mode, frequency of communication in this mode being more successful at predicting global foreign accent in native speech than contact with the native language in a bilingual mode, AOA, or LOR. The formality of a professional situation or the native language of an interlocutor who does not understand L2 items may prompt

such a monolingual mode in which little code-switching occurs. However, lack of code-switching is not always equivalent to a monolingual mode. For example in the case of interpreters, and German language instructors, code-mixing may be rare, and yet communication most likely occurs in a bilingual mode. With a view towards language mode, the results of the present study suggest that exposure to the L1 as spoken by monolinguals, where language mixing is considered inappropriate, plays an important role in maintaining the stability of a pronunciation characteristic of monolingual native speakers.

Chapter 3

Experiment II: The production of first language attrition in the domain of phonetics

3.1 Introduction to Experiment II

It is the aim of the present chapter to provide an introduction into Experiment II, which represents an investigation into the *production* of first language attrition in the domain of phonetics. Accordingly, the present experiment builds upon Experiment I, which focused on the perception of L1 attrition, in the form of foreign accent, by other native speakers. Initially, the main questions of Experiment II are presented. Thereafter, the focus is on a more detailed outline of the presentation of Experiment II in this thesis. As will be explained, in contrast to Experiment I, discussed in the previous chapter, the production analysis of first language attrition is divided into multiple chapters.

Experiment II concentrates on a small group of German native speakers who migrated to Anglophone Canada. Dutch L2 speakers were excluded from the production analysis because of the finding from Experiment I that it was more difficult to differentiate German from Dutch phonetic attributes than German from English phonetic attributes given that the dialect borders of the former languages overlap. In applying this result to Experiment II, this meant that at least some phonetic characteristics of German and Dutch may be quite similar. In other words, dialectal similarities may therefore have confounded with any potential effects of first language attrition in the domain of phonetics. Given this methodological difficulty, late consecutive bilinguals who migrated from Germany to Canada were the focus of the production analysis.

The primary question of Experiment II was whether the production of specific pho-

netic variables (lateral phoneme /l/, tonal alignment and pitch range) in the native speech of German migrants to Canada differs from the production of the same phonetic variables in German monolingual speakers in Germany, as displayed in the acoustic signal. This question was prompted given the findings from Experiment I which indicated that some native German speakers were perceived to be non-native speakers in their L1. Yet even if this had not been the case, and no participant from Experiment I had been perceived to be a non-native speaker of German, it stands to reason that the late consecutive bilingual migrants may nevertheless have exhibited L1 attrition which was detectable in the acoustic signal, although not perceivable by monolingual native speakers. As suggested in the previous chapter, the relationship between perception of foreign accent and the production of speech as displayed in the acoustic signal may not be clear. As such, an exploration into the production of native speech, both within the segmental and prosodic levels, in order to illuminate these changes in the pronunciation of L1 speech, was a prerogative of Experiment II.

The second question of Experiment II was whether first language attrition within the domain of phonetics is related to second language acquisition in the same phonetic variables. The reasoning behind this question was that previous studies (described in detail in Section 1.2.3), which have investigated the L1 and L2 of late consecutive bilinguals within the domain of phonetics, indicate that there is a general trend towards a positive correlation between L1 attrition and L2 acquisition (Flege and Hillenbrand, 1984; Flege 1987; Major 1992; Sancier and Fowler, 1997). With reference to late consecutive bilingualism, it has even been stated that “The more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from the L1 phonetic norm” (Flege et al., 2003 : p. 470). However, particularly the studies by Major (1992) and Mennen (2004) suggest that late consecutive bilinguals, who represent a seemingly homogenous group, may in fact differ in the extent of phonetic interaction between the L1 and L2. In order to investigate this second question, the speech of a second control group comprising English monolinguals in Canada was examined. Accordingly, both the L1 and the L2 of the late consecutive bilingual migrants were investigated in Experiment II.

A further question of the production analysis focused on extralinguistic variables: 1. age of arrival, 2. length of residence, and 3. amount and 4. type of contact with German. These variables were specifically investigated with the aim of exploring interpersonal variation in the bilingual migrant group which may not have been directly associated with L2 acquisition. They were predominantly chosen based on the results of Experiment I which indicated that age of arrival and language contact (more specifically in language settings in which less mixing between the L1 and L2 was expected) influenced L1 attri-

tion in the domain of phonetics. As explored in 1.3.3, it is often suggested that age of arrival influences rate of attrition, or “the younger the child is when the language of her environment changes, the faster and deeper she will attrite” (Köpke and Schmid, 2004 : p. 10). Whether age effects occur in the domain of phonetics in L1 speech in late consecutive bilingual migrants was therefore considered to be of relevance. Length of residence continued to be a focus mainly for the purpose of consistency, although the results from the perception experiment supported previous findings that there is a non-linear relationship between length of residence and rate of attrition (Schmid, 2002; Köpke and Schmid, 2004). More precisely, the initial years after migration may be pivotal in determining first language attrition. Thereafter the effects of length of residence may lessen (de Bot and Clyne, 1997). An analysis of language contact was particularly merited following the perception experiment. The effects of type of contact, as well as the overall amount of contact with German, were therefore explored. Here the question was whether more German contact, in relation to English contact, affects first language attrition in the domain of phonetics. Likewise, does the type of language contact, be it predominantly characterised by a monolingual (less language mixing expected) or a bilingual mode (more language mixing expected), impact first language attrition? On the whole there was continued interest in these variables given the theoretical reasoning that they tend to be associated with L2 acquisition (Piske et al., 2001). Hence if L1 attrition is associated with L2 acquisition (L1 attrition resulting from L2 acquisition or *vice versa*), these variables may very likely be correlated with L1 attrition.

Finally, the last question of Experiment II was whether intrapersonal variation occurred within the late consecutive bilingual migrants. This question was of relevance in part due to the findings by Major (1992), who suggests that within the same bilingual migrant, first language attrition in the domain of phonetics may vary in different circumstances.

Through investigating these questions, the overall aim of Experiment II was to attain a more conclusive picture of first language attrition at the level of speech production in late consecutive bilingual migrants.

3.1.1 Outline of Experiment II

In the remainder of Chapter 3, the general methodology of Experiment II is reported. Initially, the overall experimental procedure is discussed. Thereafter, in Section 3.2.2, information regarding the individual profiles of the bilingual subjects is documented, specifically with a view towards the mentioned extralinguistic variables. The specifications of the control subjects, and how these participants were matched with the experimental par-

ticipants, is also reported. The focus is on a comparison of the regional accents and the age at recording (AAR) of the bilingual and control participants. Thereafter, the apparatus of Experiment II is documented in Section 3.2.3. Chapter 3 is completed with an overview of the general predictions of Experiment II in Section 3.3.

The decision to divide the production analysis into four chapters, as mentioned in the previous section, was based on the fact that Experiment II examined three phonetic variables which were tested in independent phonetic tasks. These phonetic tasks are presented in the chapters following the present. In Chapter 4, the analysis of lateral production is reported. This is followed by the analyses of tonal alignment in Chapter 5, and thereafter pitch range in Chapter 6. The specific hypotheses, as opposed to the general predictions discussed at the end of the present chapter, are reported based on the contrastive descriptions of the selected phonetic variables in German and English in their respective chapters. Similarly, the results of each phonetic variable are documented and discussed in the appropriate chapters.

Finally, in the final chapter of this thesis, the results of Experiment II are discussed and interpreted in relation to each other and those of Experiment I.

3.2 Methodology

3.2.1 Experimental procedure

The recruitment procedure commences the description of the experimental procedure. This is followed by an overview of the general procedure during the interviews. Note the terminology here: ‘interview’ refers to the total time spent with each participant, whereas ‘recording’ was the part of the interview in which the participant was recorded for the phonetic tasks. The terms are generally used synonymously, but where necessary differentiated.

The recruitment of participants was conducted in three stages. The first stage focused on the late consecutive bilingual migrants in Canada. The interviews with these participants were held in December, 2006 at the Interdisciplinary Speech Research Laboratory at the University of British Columbia in Vancouver. Based on the profiles of these individuals, the second recruitment stage took place during the year of 2007. This stage involved the gathering of German monolingual control participants. These recordings were conducted at various locations in Germany because a goal was to match the German regional accents of the experimental participants with those of the control participants. As a result, it was often necessary to record participants in the region where they were resident. The phonetic departments at the Humboldt University in Berlin, the University

of Cologne and the University of Stuttgart, as well as a quiet room close to Frankfurt were used as interview locations during this stage. The third recruitment stage concentrated on the second control group of English monolinguals in British Columbia, Canada. These interviews were conducted in a quiet sound booth at the radio station CFNR in Terrace, British Columbia during the month of April, 2008. Given that the experimental participants were exposed to a more homogenous variety of English than could be expected of their native language (due to the overall variety of German regional accents in Germany compared with the relative homogeneity of English regional accents in Canada (Wells, 1982; König, 1994)), the challenge of matching English regional accents was not as great as it was for German.

During the first recruitment stage, it was initially anticipated that enough participants of the perception analysis would volunteer to participate in the second study, but this was not the case. Only four of the original participants continued on in the production analysis. These participants are hereafter referred to as 1ExBG, 4ExFS, 5ExGB, and 9ExMB. The recruitment process, conducted from Edinburgh, involved email and postal communication. It is likely that participants may not have felt as obliged to continue on due to this more indirect form of communication. Additional late consecutive bilingual migrants were approached through their affiliation to a German organisation in Canada, such as their local church. Emails were written in English to such organisations which briefly explained the research. From these initial emails to German organisations in Canada, interested participants responded directly to me and an appointment was arranged through email contact. In organising the interviews with the participants, it was specified that German native speakers who had lived in Canada for more than 10 years and who had moved to Canada in late adolescence or early adulthood were the target group. It was also noted that ideally participants should speak only English and German, although minimal knowledge of other languages would not prevent one from taking part. This was consistent with the characteristics of the participants in the perception experiment.

The bilingual participants communicated in English during these emails which ensured that they were not aware that half of the meeting would also be conducted with another interviewer in German. Participants were also not aware that phonetic aspects of their speech would be analysed during the interviews. Instead, it was emphasised during the email communication that questions would be asked during the interview with regard to language background and language community. The participants were assured that the interviews were in no way to be seen as a test. None of the participants were paid for their participation, but their travel costs were reimbursed.

For future studies involving the languages of migrants, it is worth emphasising that portions of the email communication were conducted on a more personal level. This is to

say that the formalities of the actual recording were often organised rather efficiently, but that many of the participants wanted to discuss their background quite early on, and also learn more about my own background. The overall impression was that they viewed the email communication as starting ground for the interviews and it was at times difficult to balance politeness with discreteness during these emails. Politeness was of course necessary not only for successful interpersonal communication, but also in order to ensure that interest in the interviews was maintained so that the participants would not cancel appointments. Discreteness was also necessary because it was thought that if participants were specifically informed that their German pronunciation was the focus of the interviews, they may have felt anxious, which again could have resulted in their cancelling, or it may have prompted them to ‘practice’ their German which could have affected the outcome of the experiment. Balancing politeness with discreteness was therefore achieved through various means. Sometimes distancing was practiced by purposefully not responding to emails immediately. This led to there being on the whole less communication than if emails were responded to immediately. A more formal language was also preferred in the email correspondence, which set the tone for discreteness. Moreover, it was essential to ensure that my internet site was not running before the recordings took place, as this would have enabled participants to look up my research profile.

The second stage of the recruitment process was again conducted from Scotland, but the participants were interviewed in Germany. During the second stage control participants were recruited who had quite specific profiles. This is to say that based on the profiles of the experimental participants in Canada, clearly defined profiles of the control participants were specified. These profiles specified age at recording, sex, level of education, and regional accent. A list of the profiles which were sought in the control participants was sent to various contact individuals in Germany and if the contact individual felt that he or she knew a person who matched the specified profile, arrangements were made for the specific recording to take place. Evidently, this second recruitment stage targeted individuals, rather than the more general approach applied in the first stage.

The third recruitment stage was similar to that of the second stage, only Canadian English native speakers were targeted. As already discussed, given that all late consecutive bilinguals had moved to British Columbia, variety in English regional accents was not as challenging as was the case for the recruitment of the German control group. As a result of this, it was possible to conduct the interviews in one place in British Columbia. Similar to in the second recruitment stage, contact individuals were approached in British Columbia with profiles of English control participants who were sought. If the contact individuals felt they knew someone who matched a profile, communication between myself and the control participant commenced. Accordingly, as was the case for the German

control group, each English control participant was matched with an experimental participant in Canada based on his or her age, sex, level of education and regional accent. Specific information regarding the profiles of the control and experimental participants is reported in the following section, 3.2.2.

For both stages of the recruitment of control participants, a number of generalisations hold true. Firstly, balancing discreetness with politeness was less problematic in these stages. Initial communication concentrated on informing the participant about the overall aims of the study and arranging a time for the interview. This communication was in general less personal than that with the experimental participants. Control participants were informed that there would be no right or wrong answer to the questions and that their normal, everyday language was the focus. The impression was that control participants were less likely to feel that the interviews represented a sort of test.

The second generalisation which can be made regarding the control data was that because the recruitment of control participants targeted individuals, the “best” control participants were chosen for the analysis. This meant that some of the originally recorded control participants were excluded. Some participants were excluded because it was thought that their German regional accents were not representative of the matched bilingual migrant. Others were excluded due to their age not matching the corresponding bilingual. In total, 20 control participants were included in the analysis, and 29 were originally recruited. In other words, the exclusion of some participants took place after the interviews.

Once the participants had been recruited, the interview took place, which the rest of this section reports on. The experimental procedure was divided into two halves: the English half and the German half. The order of these halves changed between the participants so that a similar amount of interviews started with English as did with German. Variation in the sequence of languages was considered to be important because the entire interview was quite lengthy (up to three hours). This duration of the interview may have impacted language performance. For example, if the last language was consistently German, this could have led to German having a weaker performance due to tiredness of the participants, rather than to the effects of first language attrition. In table 3.1, the order of the language halves is presented.

The languages were strictly separated during these halves. This meant that during the English half, only English was spoken with the interviewer (myself) and during the German half, only German was spoken with the interviewer (A. Lenz). In both halves, native speakers (according to the definition of this thesis) of the respective language conducted the interview. The participant was led to the recording room by the first interviewer in the language of the respective half. When that half was over, the next interviewer entered once the first interviewer had already left. The participants never saw nor communicated

Bilingual participant	First language	Second language
1ExBG	English	German
2ExCL	English	German
3ExDZ	German	English
4ExFS	English	German
5ExGB	German	English
6ExIKH	German	English
7ExID	German	English
8ExMZ	German	English
9ExMB	English	German
10ExRMW	English	German

Table 3.1: Language order in Experiment II. The first language is the language which was used in the first half of the interview. The second language is the language which was used in the second half of the interview.

with the interviewers at the same time, until the interview was over. This strict separation of languages was enforced in order to ensure to the greatest extent possible that the production of each language by the bilinguals reflected their abilities in the particular language. As such, the assumption was that the German and English produced by the bilinguals in these interviews was more representative of a monolingual mode than of a bilingual mode (Grosjean, 2001). In contrast, it could be argued that a bilingual mode may have been characterised by a pronunciation with attributes characteristic of both German and English, and would therefore not have represented the true capabilities of the participants in each language. The aim was to test language competencies, rather than language performance, although as discussed previously in Section 1.2.2, the dimensions of these terms are far-reaching. Once the total interview with the participants was complete, the participants were informed that in fact each interviewer spoke the other language. In all cases, the participants expressed (sometimes great) surprise over this as they openly admitted that they had not been under the impression that the interviewers were proficient in both German and English. This supported the assumption that they had not been more inclined towards a bilingual language mode during the interviews.

When a participant arrived at the recording studio, the procedure was as follows. Firstly, the welcoming of the participant took place. He or she was offered still water, herbal tea or apple juice and his or her jacket was taken. The participant was then led to the recording room and an overview of the experimental procedure was explained by the interviewer. After this explanation, the participant was able to ask questions about the experiment and these were answered as openly as possible without divulging that phonetic aspects of first language attrition were being investigated. Instead it was explained that the focus was on their personal impressions, and that there were no right or wrong answers. In

the case of the participants wanting more definite information, it was emphasised that the objective of the research was to attain more information regarding the multicultural and linguistic situation of the Vancouver area. If this still wasn't enough, the participant was asked whether it would be possible if more precise details were given once the recording had taken place. It was also explained that if the participant felt uncomfortable with any questions or aspect of the study, he or she could terminate the experiment without giving an explanation. The offer of obtaining more precise information after the experiment was over was accepted in such cases, at which point the consent form was signed by both the investigator and the participant.

Once this introduction had taken place, the language background questionnaire of the appropriate language was the next step. Given that the languages were separated, the focus of the questions in each language background questionnaire was on the respective language of that particular half. For example, one of the questions in the German half was "If applicable, how much German do you speak with your grandchildren(?)". In the English language background questionnaire the question was "If applicable, how much English do you speak with your grandchildren(?)". The investigator read the questions out to the participant, sometimes showing the participant the question on the form, and the participant was able to respond to the investigator. The interviewer then made notes and filled out the questionnaire in accordance with the responses of the participant. It was thought that the reading out loud of the questions would create a more informal, conversation-like setting, which would help the participants to feel at ease. Participants were told that they could expand on the questions if they felt there was something else which they wanted to add. Enabling the participant to interact with the interviewer in the respective language was aimed at activating the given monolingual language mode more than if the participant had silently answered the questionnaire on his or her own.

Once the language background questionnaire was complete, the phonetic section took place. The first phonetic task was the lateral word list (see Appendix B.1 for the German word list and Appendix B.2 for the English word list). After the lateral task, there was a break of approximately five minutes. Thereafter, the tonal alignment task was conducted (see Appendix C.1 for the German sentences used in the tonal alignment analysis and Appendix C.2 for the English sentences). Once the tonal alignment task was over, there was another break of approximately five minutes and then the pitch range task occurred (see Appendix D.1 for the German story used in the pitch analysis and Appendix D.2 for the English story). The specific methodology relevant to these phonetic tasks can be found in their respective chapters. This overall procedure was repeated twice, once in each language half, although the introduction and signing of the consent form only occurred in the first language half.

The total duration of the interviews amounted to between 2.5 and 3 hours for each bilingual participant. Variation in duration of the interviews was a result of not wanting to interrupt bilingual participants when they expanded on answers in the language background questionnaire.

The duration of the control interviews was less than half of this time. In general, there were fewer questions asked of the control participants. This was because their questionnaire controlled for age, sex, education and regional accent, but other aspects of the bilinguals' questionnaire were not applicable. For example, the question of how often one returned home to Germany was not applicable to the control participants. Here the objective was to determine that the participants were representative monolingual native speakers of their given language and that they met the profiles of the bilinguals. All control participants were asked whether they felt that they were monolingual speakers of their language, and all answered yes to this question. No control participant felt that another language could have influenced the pronunciation of their native language in any way. All control participants stated that they either never or almost never used the other language (hence German or English, dependent on their L1) in their daily lives. I conducted all of the control recordings, both in English and in German and only the language of the control participants was used in these recordings.

A final note is that a trial experiment was conducted at Queen Margaret University, Edinburgh in October, 2006, in order to practice the described experimental procedure before applying it in Canada. For this trial experiment, three German-English bilinguals were recorded. The results of the trial experiment are not reported in this thesis because the purpose of it was to ensure that data collection would progress smoothly in Canada, not to investigate first language attrition in the domain of phonetics in the trial participants. Minor changes were made to the experimental procedure after the trial experiment. For example, it was decided that breaks should be inserted between the phonetic tasks and that participants should be given a contact telephone number in case they needed to postpone the interview.

3.2.2 Subjects

Ten late consecutive bilinguals in Anglophone Canada were included in the production analysis of L1 attrition in the domain of phonetics. Originally, 13 migrants from Germany to Canada were recorded. Three of these participants were excluded from the analysis for various reasons. One participant had migrated from Germany to Canada when he was 10 years old. This young age of arrival in relation to the other participants (see Table 3.2) meant that if aspects of his German speech were different from the German mono-

lingual norm (represented by the control group from Germany), it would not be able to be assumed that this was due to L1 attrition. Instead it may have been caused by a lesser level of acquisition of the German language. Another participant was considered to be inappropriate because he had only lived in Canada for 6 years, whereas the other participants had all resided in Canada for over 18 years (see Table 3.2). The third participant was excluded for numerous reasons. On the one hand, his speech had high portions of creaky voice.¹ The portions of aperiodicity and low frequency in his speech signal made the pitch analysis, as well as parts of the lateral and tonal alignment analysis, unreliable. Moreover, this participant had a rather monotonous voice, creating additional difficulties in the tonal alignment and pitch range analyses. Finally, a further reason to exclude this participant was that he indicated that his German was highly influenced by a regional accent, that of *Ostfränkisch*, which was verified by the German interviewer and myself. The effects of highly regionally coloured German speech on the phonetic variables may have confounded with potential first language attrition and for these reasons this individual was excluded from the analysis. Regional accent is discussed in more detail in Section 3.2.2.

Participant	AOA	LOR
1ExBG	16	48
2ExCL	19	22
3ExDZ	24	55
4ExFS	21	53
5ExGB	32	29
6ExIKH	29	18
7ExID	20	49
8ExMZ	32	48
9ExMB	23	38
10ExRMW	23	40

Table 3.2: The age of arrival to Canada (AOA) and length of residence in Canada (LOR) of the bilingual participants of Experiment II.

As already mentioned, in addition to the four participants who had taken part in the first experiment, six other participants were included in the analysis of the second experiment. These participants were 2ExCL, 3ExDZ, 6ExIKH, 7ExID, 8ExMZ and 10ExRMW. None of the participants had phonetic training, nor any form of language impairment which may have caused for their language production to be affected. Whether the participants smoked was not assessed.

¹Creaky voice is characterised by low levels of longitudinal tension as well as closure along the entire length of the glottis and anterior vibration of the vocal folds. The result is often a pitch contour with high levels of aperiodicity and a fundamental frequency as low as 20 Hz (see amongst others Neppert, 1999, Hewlett and Beck, 2006 and Hayward, 2000).

In Table 3.2 the bilingual participants age of arrival (AOA) to Canada as well as their length of residence (LOR) is documented. The youngest age of arrival was that of participant 1ExBG which was 16 years of age, whereas the oldest age of arrival was 32 years of age on the part of participants 5ExGB and 8ExMZ. The participants therefore fulfilled the criterion of the initial advert specifying that age of migration must have taken place in late adolescence to early adulthood, ensuring that L1 acquisition was complete upon migration. None of the participants had been to Canada before they migrated and all reported that their English was rudimentary upon arrival to Canada. This is to say that in most cases they had received school education of English, but did not consider themselves to be fluent in English before they came to Canada (see Table 3.3). In fact, participant 7ExID noted that she didn't speak a word of English when she arrived. The bilingual migrants emphasised that L2 language difficulties were a major obstacle for them when they arrived in Canada. It is therefore the claim in this thesis that AOA to Canada represented not only date of migration but also the onset of English acquisition. This is important to emphasise because it means that the German of the experimental participants was not affected by English acquisition before the age of arrival, hence the possibility of the L2 influencing the L1 began at the earliest in late adolescence. In this way, it was possible to determine whether the predictor variable of AOA impacts level of L1 attrition in the domain of phonetics in speakers who acquire their second language after the full acquisition of their native language (see Section 1.3.3).

From Table 3.2 it is evident that all participants, except for participant 6ExIKH, had spent a longer portion of their lives in Canada than in Germany. The shortest length of residence was that of participant 6ExIKH who had lived in Canada for 18 years, whereas the longest was that of participant 3ExDZ who had resided for 55 years. In contrast, participant 3ExDZ had lived in *Germany* for 24 years. If Table 3.4 is compared with Table 3.2, an inconsistency between age at recording (AAR), AOA and LOR for participant 1ExBG is evident. This is because participant 1ExBG lived in Tanzania and Kenya for 8.5 years between the ages of 29 and 37. During this time, 1ExBG spoke and taught English and he also learned some Swahili. As reported in Section 1.3.3, length of residence is cited as a potential predictor variable in the process of first language attrition. It is for this reason that it was explored in the production analysis.

For most bilingual participants there was a high age at recording (see Table 3.4). This may have been caused by the advert which was used to attract participants. Here it was specifically stated that migrants who had resided in Canada for an extended period of time, and who had arrived in adolescence or early adulthood, were required for the project. As such, it is possible that elderly people were more likely to have felt that they fulfilled the requirements of the study. Moreover, because it was specified in email communication

Participant	Years
1ExBG	4
2ExCL	9
3ExDZ	4
4ExFS	5
5ExGB	5
6ExIKH	6.5
7ExID	0
8ExMZ	5
9ExMB	6
10ExRMW	9

Table 3.3: Years bilingual migrants spent learning English before moving to Canada.

that the interviews would take up to 3 hours, it is also possible that retired individuals felt that they had more time to donate to such a study. It is therefore important to emphasise that during the interviews all individuals gave a strong impression of being active and articulate and showed no signs of impairment. In fact, during the individual conversations with the participants who were over 70 years, the impression was given that they felt proud of being so fit, both mentally and physically. As such, any attritional effects in the native language were not interpreted to be a result of old age.

Still, even in healthy aging, differences in speech between younger and older subjects have been documented (Linville and Rens, 2001; Endres et al., 1971; Linville, 1996). Age at recording was therefore controlled for in the gathering of control participants. This means that each person in the experimental group was matched with two control participants (one in the German language and one in the English language) who was in a similar age bracket. The cut-off for this selection was ± 10 years in relation to the age of the experimental participant. Admittedly, ± 10 years with regard to a 41 year old experimental participant (2ExCL) is relatively larger than a ± 10 cut-off with regard to an 80 year old participant (8ExMZ). For the sake of clarity during the recruitment process, this drawback was conceded to as it was felt that varying age range would have been confusing for the contact individuals who helped with the recruitment of control participants. The mean age at recording of the bilingual participants was slightly higher (64.6 years) than the mean age of the German control group (62.4 years) and the mean age of the English control group was the highest at 66.4 years. The challenges involved with the acoustic analysis of speech in an older population are further discussed within the methodology sections of each phonetic task.

As already mentioned, experimental subjects were matched not only according to age at recording, but also with regard to whether they were male or female (see Table 3.5).

Bilingual group		German control		English control	
Participant	AAR	Participant	AAR	Participant	AAR
1ExBG	72	1CGGH	74	1CCDH	68
2ExCL	41	2CGSS	37	2CCCZG	41
3ExDZ	79	3CGHD	76	3CCBH	72
4ExFS	73	4CGHWS	67	4CCVEC	71
5ExGB	61	5CGSB	57	5CCJS	67
6ExIKH	47	6CGDM	38	6CCBC	55
7ExID	69	7CGLH	82	7CCFS	77
8ExMZ	80	8CGHH	71	8CCLMS	81
9ExMB	61	9CGES	64	9CCEJ	67
10ExRMW	63	10CGEL	58	10CCLK	65
Mean	64.6 (12.8)		62.4 (15.2)		66.4 (11.3)

Table 3.4: The age at recording (AAR) in years of the bilingual experimental and control participants in Experiment II. The standard deviations are given in brackets behind the mean at the bottom of each column.

In total, three males were included in the bilingual group, and seven females. This meant that, including the control groups, there was a total of 9 males and 21 females. The main reason why participants were matched according to sex was to ensure that differences in the acoustic signal were not a result of anatomical differences. Although it has been suggested that sex is not related to first language attrition (Yağmur, 1997), this possibility was able to be explored given that sex was controlled for. Information regarding the sex of participants is displayed in Table 3.5.

Bilingual group		German control		English control	
Participant	Sex	Participant	Sex	Participant	Sex
1ExBG	Male	1CGGH	Male	1CCDH	Male
2ExCL	Female	2CGSS	Female	2CCCZG	Female
3ExDZ	Male	3CGHD	Male	3CCBH	Male
4ExFS	Male	4CGHWS	Male	4CCVEC	Male
5ExGB	Female	5CGSB	Female	5CCJS	Female
6ExIKH	Female	6CGDM	Female	6CCBC	Female
7ExID	Female	7CGLH	Female	7CCFS	Female
8ExMZ	Female	8CGHH	Female	8CCLMS	Female
9ExMB	Female	9CGES	Female	9CCEJ	Female
10ExRMW	Female	10GCEL	Female	10CCLK	Female

Table 3.5: The sex of the participants in Experiment II.

In general, bilingual participants were well educated, and this was additionally controlled for when choosing appropriate control participants, as suggested by Cook (2003). In Table 3.6, the highest level of education of the bilingual and control participants is docu-

mented. Level of education was considered to be relevant because studies have shown that this variable may impact first language attrition (Jaspaert and Kroon, 1989). Moreover, as discussed in Section 1.3.3, the place in which the education took place may influence L1 attrition (Yağmur, 1997). Accordingly, the amount of education received in Germany is also reported in Table 3.6. As displayed, the education level of the control participants was generally similar to that of the bilingual migrants.

Summarising this section, it is noted that bilingual participants were matched with control participants with regard to age at the time of recording, sex, and level of education. Regional accent, which was also matched for in the control and experimental groups, is discussed in greater detail in the following section. Moreover, age of arrival to Canada on the part of the bilingual participants was older than late adolescence to early adulthood. Length of residence in Canada extended beyond 18 years for the late consecutive bilinguals. These predictor variables were of particular interest in an attempt at explaining interpersonal variation in the phonetic variables. Language contact, another predictor variable investigated in Experiment II, is discussed after regional accent in the remaining portion of this chapter.

Bilingual group			German control		English control	
Participant	Education in Germany	Education in Canada	Participant	Education	Participant	Education
1ExBG	<i>Abitur</i>	Master (7)	1CGH	<i>Habilitation</i>	1CCDH	Master
2ExCL	<i>Abitur</i>	Bachelor (6)	2CSS	<i>University Diplom</i>	2CCCZG	Bachelor
3ExDZ	<i>Mittlere Reife</i>	Technical courses (1)	3CHD	<i>Fachabitur</i>	3CCBH	Technical courses
4ExFS	<i>Mittlere Reife</i>	Bachelor (4)	4CHWS	<i>Mittlere Reife</i>	4CCVEC	Master
5ExGB	<i>Mittlere Reife</i>	Technical courses (3)	5CSB	<i>Abitur</i>	5CCJS	Technical degree
6ExIKH	<i>Mittlere Reife</i>	Bachelor (6)	6CDM	<i>University Magister</i>	6CCBC	Technical degree
7ExID	<i>Hauptschule</i>	Technical courses (0.5)	7CLH	<i>Hauptschule</i>	7CCFS	High school
8ExMZ	<i>Abitur</i>	Technical courses (1)	8CHH	<i>University Lehramt</i>	8CCLMS	Technical courses
9ExMB	<i>Mittlere Reife</i>	Technical degree (1)	9CES	<i>Mittlere Reife</i>	9CCEJ	Bachelor
10ExRMW	<i>University Diplom</i>	Bachelor (7)	10CEL	<i>Mittlere Reife</i>	10CCCLK	Technical degree

Table 3.6: The highest level of education of the bilingual and control participants. For the bilingual participants, the country in which they received this education is specified. For the control participants, their place of residence was where they attained their highest level of education. The approximate amount of education in years is given in brackets.

Regional accents

The participants also assessed their regional accent(s). As already discussed, this was done in an attempt to control for regional accent, so that German and English monolingual control participants could be appropriately matched with the bilingual participants. Specifically, participants were asked to decide whether a regional accent influenced their German speech at present; if so, to what extent (here there was the choice between *ein bisschen* ('a bit, or slightly') and *stark* ('a lot, or strongly')); which regional accent(s) they felt influenced their German speech; and to explain why they had named the specified regional accent(s). The same was asked of their potential regional accent(s) before the participants moved to Germany, or in childhood. It was thought that some participants may have had a different outlook on their regional accent before and after their move to Canada. For example, participants may have felt that their regional accent had been stronger in childhood than it was in Canada. If only the present regional accent had been assessed, any potential dialectal influence, still present although not disclosed in the questionnaire, may not have been able to be accounted for.

The reasoning behind asking for the participants' regional accent was to ensure that the dialectal background of the participants did not confound with first language attrition in the domain of phonetics. As has already been stated, one of the individuals recorded was excluded from the analysis for precisely this reason, because he came from the dialectal region of *Ostfränkisch*, in which /l/ is darker than in Standard German (see Chapter 4). In the relevant sections of the phonetic tasks, regional variation will be looked at more closely in relation to the appropriate phonetic element. Here it is emphasised that in German, the bilingual and control participants described their German native speech as being in no way or only slightly influenced by a regional accent. A summary of the bilingual participants' self-assessments of regional accent is displayed in Table 3.7 on the following page. More information regarding regional accents in the bilingual and control participants can be found in tables A.5, A.6, A.7, and A.8 of Appendix A. Where appropriate, the responses to this section of the language background questionnaire will be discussed.

Rather than relying on self-assessments, it could be argued that a perceptual experiment may have been more effective at assessing regional accent. However, conducting a perceptual experiment investigating specific regional accents in the experimental group with German monolingual listeners was thought to be disadvantageous. This was because it was decided that inexperienced listeners may have had trouble pin-pointing a particular regional accent if it was overlaid with an English foreign accent. Statements made by the German monolingual listeners in Experiment I (see Section 2.4), indicating that dialect

Participant	Summary of regional accent self assessment
1ExBG	Slight <i>Pfälzer</i> regional accent as child due to his father. Presently no regional accent.
2ExCL	No previous regional accent in Germany. Presently no regional accent.
3ExDZ	Slight <i>Berliner</i> regional accent as child because he grew up here. Presently no regional accent.
4ExFS	No previous regional accent in Germany. Presently no regional accent.
5ExGB 6ExIKH	Slight <i>Sauerländisch</i> regional accent as child because she grew up here. Slight <i>Hamburger</i> regional accent because she grew up here. Presently no regional accent.
7ExID	Slight Swabian mixed with Swiss German regional accent because she grew up in Swabia and her mother was from Switzerland. She also lived near Basel in Switzerland from 14-34 years. She presently has a slight regional accent due to the same reasons.
8ExMZ	Strong <i>Hessisch</i> regional accent as child, then slight <i>Berliner</i> regional accent when she lived in Berlin (6-24 years). Presently no regional accent.
9ExMB	Slight Northern German regional accent as child because she grew up here. Presently slight Northern German regional accent for the same reason.
10ExRMW	Slight <i>Hessisch</i> regional accent as child because she grew up here. Presently slight <i>Hessisch</i> regional accent for the same reason.

Table 3.7: Summary of the bilingual migrants' self-assessment of regional accent.

and foreign accent were sometimes difficult to differentiate, supported this decision.

Instead, a German phonetician, Edith Braun, who specializes in German dialects, also listened to controlled portions of the participants' recordings and gave her opinion on the extent of regional accent in each recording. This assessment was performed in her home. She wore a headset and the sentences from the tonal alignment exercises were assessed. It was explained that it was important she listened for the specific regional accent of each participant, even if some of the individuals may have also had foreign accented speech. Her comments were not decisive in interpreting and categorising potentially regionally accented speech, but they reinforced the participants' own assessment of their regional accent, as well as my own (namely in both cases that the participants' German was either not influenced by a regional accent, or only weakly influenced). In summarising her comments (see Table 3.8 on the next page), it is worth noting that only two of the included participants had a slight regional accent in her view. She also listened to the participant with an *Ostfränkisch* dialect and noted his strong regional accent. Participant 1ExBG had in her opinion a very slight East or West Prussian accent. In fact, 1ExBG was born in West Prussia (see Table A.1 for a description of all places of birth of the bilingual subjects and Table A.2 for the control participants' place of birth). She also noted that participant 7ExID had an accent from Southern Germany, potentially coming from either Swabia or the area of *Ostfranken*. In fact, participant 7ExID grew up in Swabia but lived in Switzerland from 14 - 34 years of age (see Table A.3 for a listing of where the bilingual migrants grew up and Table A.4 for where the control participants grew up).

For the remaining participants, the phonetician emphasised that no regional accent was prevalent, although she did comment on differing degrees of English accented German speech. In particular regarding English accented speech, she noted that she could hear a strong English accent in participants 4ExFS and 10ExRMW. She heard a slight English accent in participants 3ExDZ, 7ExID and 9ExMB. In contrast, she heard no English accent in participants 1ExBG, 2ExCL, 5ExGB, 6ExIKH and 8ExMZ. These comments were interesting, but not included in the empirical analysis due to the fact that the phonetician had been fully informed beforehand that she would be hearing potentially English accented speech. She was told this in order to help her in isolating regionally accented speech. In other words, although her comments regarding English accented speech were interesting, the point of the listening exercise was to determine regionally accented speech.

In sum, regional accent was controlled for in the present study by matching the bilingual participant's regional accent with that of a control participant. In general, participants' German was coloured only slightly, if at all, by a regional accent. Nevertheless, where deemed necessary, regional variation in the participants' speech is approached in

Participant	Phonetician's description of regional accent
1ExBG	Very clear speech with a slight East or West Prussian regional accent
2ExCL	No regional accent, neutral German speech
3ExDZ	Very clear speech, no regional accent
4ExFS	Very clear speech, no regional accent
5ExGB	No regional accent, High German
6ExIKH	No regional accent, High German
7ExID	Slight Southern German regional accent, Swabian or <i>Ostfränkisch</i>
8ExMZ	Very clear speech, no regional accent
9ExMB	No regional accent
10ExRMW	No regional accent

Table 3.8: This table summarises the German phonetician's description of each bilingual migrant's regional accent.

the coming chapters devoted to the phonetic analyses.

Language contact

A further question addressed in this project was whether L1 attrition is linked to the amount and type of contact a migrant has with his or her native language. The aim was to come up with a robust way of quantifying amount and type of language contact in order to further characterise the bilingual migrants.

Information regarding language contact was obtained through the language background questionnaire. Selected portions of the questionnaire which were of particular relevance are discussed in this section, rather than all answers to all questions. In particular, the process of quantifying language contact is reported here, which enabled these variables to be applied in the analysis of interpersonal variation in the phonetic tasks.

Firstly, a general statement at this point is that both the overall amount of language contact, as well as the amount of mixing *within this overall amount*, was quantified in Experiment II. Amount of contact was an averaged variable which focused on the present language network of the participants. This predictor variable was calculated based on responses to both the German and the English language background questionnaires. For example, in the English questionnaire, the following question was posed: "Could you please indicate to what extent you use English with the following people? Also, to what extent do these people speak English with you?" Various members of the participant's potential language community were:

- my partner;
- my children;

- my grandchildren;
- my relatives (aside from the above);
- my partner's relatives (aside from the above);
- my friends in Canada;
- my friends in Germany;
- my colleagues in Canada; and
- my colleagues in Germany.

For each category, the option of choosing between 'Always', 'Usually', 'Sometimes', 'Rarely', or 'Never' was given. The bilingual participant therefore indicated not only the extent to which he or she spoke English, but also the extent to which English was spoken to him or her. When a category was not applicable to the participant, for example because he or she had no children, the category was left empty.

In the corresponding German questionnaire, a translation of the same categories was completed by the participants with the option of choosing between '*Immer*', '*Meistens*', '*Manchmal*', '*Kaum*', or '*Nie*'. As such, these questions were answered twice by each participant - once with regard to German and once with regard to English.

Two scales were created from each questionnaire. The first scale represented the amount, or quantity, of contact the participant had with either German or English for each category (denoted as respectively $A_{GermanC}$ and $A_{EnglishC}$). This scale can be seen in Table 3.9. Translations are given in this table, although the participant did not receive these translations because the languages were separated as much as possible during the actual interviews, as discussed in Section 3.2.1.

Participant's Choice	Quantity of Contact on Scale
<i>Immer</i> - Always	1
<i>Meistens</i> - Usually	0.75
<i>Manchmal</i> - Sometimes	0.5
<i>Kaum</i> - Rarely	0.25
<i>Nie</i> - Never	0

Table 3.9: The scaling used for quantifying the amount of contact participants had with members of their language community in German and English. *Immer*, or Always (dependent upon the language half of the interview) denoted the most amount of contact with that particular language, whereas *Nie*, or Never, denoted the least amount of contact with that particular language.

The second scale represented the amount of mixing, or quality of contact, the participant had with either English or German. This scale is displayed in Table 3.10. As was the case with Table 3.9, translations are given here, but the participant did not receive translations. If participants noted that they ‘Always’ or ‘*Immer*’ spoke either English or German with the specified members of their language community, it was assumed that no mixing occurred with these individuals. The same was true if the participants noted that they ‘Never’, or ‘*Nie*’ spoke that language with the specified members. On the other hand, ‘Usually’, or ‘*Meistens*’ and ‘Rarely’, or ‘*Kaum*’ indicated somewhat more language mixing. ‘Sometimes’, or ‘*Manchmal*’, was interpreted as the most language mixing.

Participant’s Choice	Quality of Contact on Scale
<i>Immer</i> - Always	.0
<i>Meistens</i> - Usually	.25
<i>Manchmal</i> - Sometimes	.5
<i>Kaum</i> - Rarely	.25
<i>Nie</i> - Never	.0

Table 3.10: The scaling used for quantifying the quality of contact participants had with members of their language community in German and English.

When investigating quantity of contact with German, each category which was completed by the participant was given a value according to the scale. For example, if a participant (9ExMB) marked that she always spoke German to her partner, but that he usually spoke German to her, the average of 0.88 was calculated for this category ($\frac{1+0.75}{2} = 0.88$). This procedure was carried out for each completed category by the participant in each language. In all but two cases, the amount of contact with German plus the amount of contact with English was more than 1.0. This meant that participants tended to over-assess the amount of language contact, since, theoretically, the following should hold for each category.

$$A_{EnglishC} + A_{GermanC} = 1 \quad (3.1)$$

For instance, participant 9ExMB claimed that she always spoke English to her friends in Canada, and that they always spoke English to her. Her average amount of English contact for this category was therefore 1.0. However, for the same question in the German section, she claimed that she rarely spoke German to her friends in Canada, and that they similarly rarely spoke German to her. This meant that the average amount of German contact for this category was 0.25, contradicting the claim that she *always* spoke English with her friends in Canada.

In order to solve this problem, the normalised total amount of language contact was obtained for each category ($A_{GermanNormalisedC}$ and $A_{EnglishNormalisedC}$), which was derived from the absolute total amount (in this case 1.25), as shown in the equations below.

$$A_{GermanNormalisedC} = \frac{A_{GermanC}}{A_{EnglishC} + A_{GermanC}} \quad (3.2)$$

$$A_{EnglishNormalisedC} = \frac{A_{EnglishC}}{A_{EnglishC} + A_{GermanC}} \quad (3.3)$$

This gave rise to the normalised amount of contact each participant had with each language for the given category. In this case, 0.2 of the participant's contact with her Canadian friends was in German, and 0.8 of the contact was in English.

In the above example of participant 9ExMB, the assessment of the language input (the extent of English or German spoken to the participant) and language output (the extent of English or German spoken by the participant) was the same. In some cases, however, the language input and language output were not identical for the same category. For example, if a bilingual migrant (10ExRMW) indicated that she always spoke English to her relatives and that they never spoke English to her, the average amount of English contact for this category was averaged to 0.5. This averaged absolute amount underwent the same normalisation process as if there had been no difference in input and output.

Once each of the maximum of nine categories had been normalised, an average amount of language contact was obtained for each participant ($A_{GermanNormalised}$ and $A_{EnglishNormalised}$). The following equations describe this process for both German and English with n denoting the number of answered categories ($n \leq 9$).

$$A_{GermanNormalised} = \frac{1}{n} \sum_{C=1}^n A_{GermanNormalisedC} \quad (3.4)$$

$$A_{EnglishNormalised} = \frac{1}{n} \sum_{C=1}^n A_{EnglishNormalisedC} \quad (3.5)$$

The exact amounts of language contact compared with the normalised data are displayed in Appendix A in Table A.9. The normalised amounts for each participant are displayed in Table 3.11 for German, which follows. These specific values regarding the amount of German in a migrant's network and the total amount of language mixing in German were applied as predictor variables in the analysis of the phonetic results. In general, it can be said that the participants varied in the amount of German contact in their networks. For example, participants 1ExBG, 2ExCL, 4ExFS, 6ExIKH, and 7ExID had clearly more English language contact than German. In contrast, participants 3ExDZ,

and 5ExGB had an average of more contact with German than with English. Participants 8ExMZ, 9ExMB and 10ExRMW had approximately an equal amount of English and German contact.

	Amount of German in network	German mixing total
1ExBG	0.269	0.250
2ExCL	0.356	0.167
3ExDZ	0.657	0.500
4ExFS	0.354	0.179
5ExGB	0.593	0.286
6ExIKH	0.250	0.167
7ExID	0.394	0.194
8ExMZ	0.539	0.286
9ExMB	0.504	0.250
10ExRMW	0.426	0.350

Table 3.11: Amount of German language contact and amount of language mixing in German.

Moving on, a high amount of mixing in German, quality, was attained if, for example, a participant noted that he ‘sometimes’ spoke German with his children, and that they ‘sometimes’ spoke German with him. In order to determine the amount of mixing in German for each bilingual migrant, the average from all categories (according to the quality scale, see Table 3.10) was calculated. Note that this data was not normalised.

In the above example, the amount of German contact was similarly 0.5 here, but these scales (quantity and quality) were not necessarily correlated with each other. A low amount of mixing was assumed if ‘Always’ or ‘Never’ were chosen, whilst the former would have indicated a high amount of contact, and the latter was indicative of a low amount of contact. For example, participant 8ExMZ ‘always’ spoke German with her friends in Germany. Participants 1ExBZ and 4ExFS on the other hand ‘never’ spoke German with their partners. Moreover, as was reported by participant 10ExRMW with regard to her relatives, even if the input was noted as ‘always’ and the output was noted as ‘never’, no mixing was interpreted, whereas 0.5 was calculated for the amount.

In Figure 3.1, the overall amount of contact with German and the amount of mixing is portrayed. Here it is evident that individuals who had a high amount of contact with German also mixed the most. This strong positive correlation ($r = .75, p < .001$) between amount and mixing is not a by-product of the quantification process. It is alternatively possible for migrants to have tended towards little contact with German, and have mixed to the same degree as they evidenced in this study. For example, the correlation between amount of English contact and amount of mixing in English was not only much weaker

	Amount of English in network	English mixing total
1ExBG	0.731	0.188
2ExCL	0.644	0.083
3ExDZ	0.343	0.500
4ExFS	0.646	0.028
5ExGB	0.407	0.214
6ExIKH	0.750	0.250
7ExID	0.606	0.357
8ExMZ	0.461	0.281
9ExMB	0.496	0.179
10ExRMW	0.574	0.200

Table 3.12: Amount of English language contact and amount of language mixing in English.

than it was for German, it was also a negative correlation, $r = -.52$, $p < .05$ (see Table 3.12). This means that the more contact bilinguals had with German, the more they mixed, whereas the more contact the bilinguals had with English, the less they mixed. As already mentioned, in the phonetic analysis of the forthcoming chapters, the quantification of amount and type of German contact were used as predictor variables.

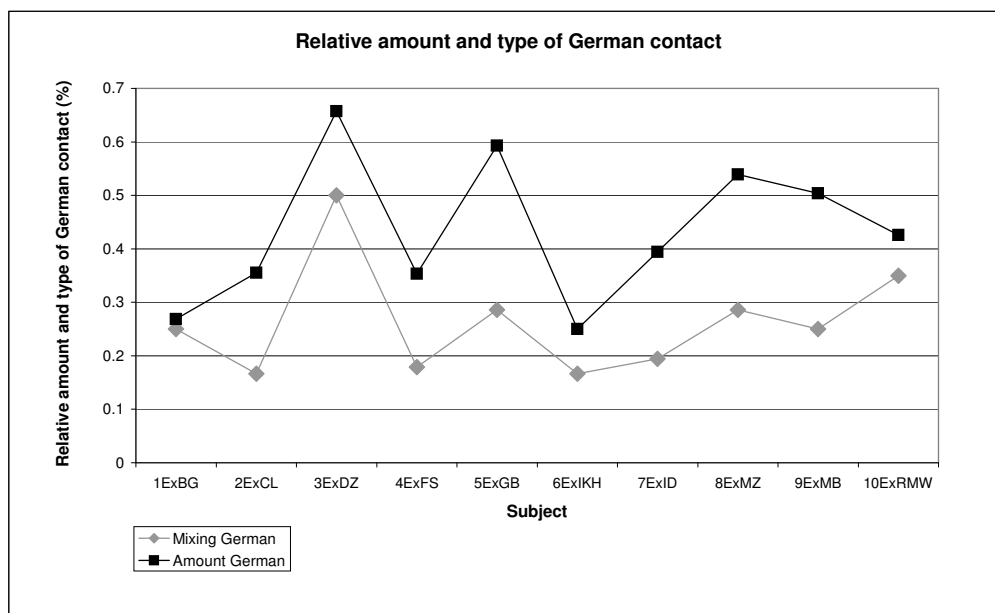


Figure 3.1: Relative amount and type of contact maintained with the German language on the part of the bilingual migrants in Canada.

Other information about the participants was documented through the questionnaire, such as frequency of visits to Germany and contact with German media. Language iden-

tity questions were also asked and selected answers to this relatively information rich questionnaire are listed in Appendix A.

Recapping, the aim of the quantification process was to come up with a robust variable which could be used in interpreting the role of language contact in first language attrition in the domain of phonetics. There are, however, numerous ways to critique this procedure. Admittedly, it is arguable that ‘sometimes’ speaking English and ‘sometimes’ speaking German does not necessarily mean that language mixing occurs. It is feasible that some participants ‘sometimes’ speak German, but only in the evenings, and that during the day they speak English. In such a case, little language mixing would actually occur and the quantification of language mixing may have lost validity. However, the impression during the interviews was that ‘sometimes’ really did refer to language mixing, meaning that both languages were used interchangeably with the network category.

Another critique of the quantification of language mixing was that it did not address differences between intersentential and intrasentential language mixing, which may have had different effects on L1 attrition in the domain of phonetics. Alternatively, it is in fact quite feasible that the effects of these types of mixing on pronunciation would be similar. Moreover it is possible to critique that the quantification process was that each category was weighted evenly. It could be argued that the impact of language contact with a person’s partner would be more substantial than with a person’s friends. Nevertheless, although the quantification process may have had disadvantages, it was thought that in general it expressed the overall amounts of quantity of language contact and mixing within the languages. As already mentioned, it was specifically the values regarding the German language (see Table 3.11) which were applied as predictor variables when interpreting first language attrition in the domain of phonetics.

3.2.3 Apparatus

As already mentioned, all recordings were made in quiet to sound proof rooms. The locations of these rooms varied, as previously discussed in Section 3.2.1 on page 70. The same Marantz flash recorder and AKG condenser microphone were used for all recordings. The test materials were digitised at 44.1 kHz sampling rate. The programme Cool Edit was used to segment the recordings before speech analysis began. Praat (Boersma and Weenink, 2008) was implemented for the actual speech analysis. For the statistical analysis, both Excel and SPSS were used.

3.3 General predictions for Experiment II

The general predictions for Experiment II, which are briefly outlined here, incorporate more specific hypotheses.

In Experiment II, there are three sets of hypotheses for each phonetic element. This means that in Chapter 4, there are three sets of hypotheses regarding the lateral phoneme /l/; in Chapter 5, there are three sets of hypotheses regarding tonal alignment; and in Chapter 6, there are again three sets of hypotheses regarding pitch range. These sets investigate group trends, rather than inter- and intrapersonal differences within individual participants.

In each chapter, the **first set** of hypotheses refers to differences between the control groups. The general prediction is that the specified phonetic variable will differ between the control groups. The positive outcome of this prediction is a prerequisite for the analyses thereafter.

The **second set** of hypotheses refers to first language attrition in the domain of phonetics. The general prediction here is that production will differ in the German of the late consecutive bilingual migrants in comparison to the German of the control group. Differences observed between the German of the migrants and the German control group is interpreted as evidence for first language attrition.

The **third set** of hypotheses is related to the languages of the bilinguals. Based on the dominant evidence from other studies into first language attrition (see Section 1.2.3), the general prediction is that a merging effect will be evident in the phonetic variables of the two languages of the bilinguals. This is to say that the phonetic variable in the German speech of the bilinguals will be similar to the same phonetic variable in their English speech. Given that in the second set of hypotheses the prediction was that the phonetic variable in the bilinguals' German speech will differ from the German control group, the consequence of this final prediction is that the (merged) phonetic variable will move towards the phonetic variable of the English monolingual control group - although it would, theoretically, be possible for both variables to move *away* from both monolingual norms.

These hypotheses with regard to group trends are augmented by an analysis of variation within the bilinguals. In order to conduct this investigation, the **third set** of hypotheses was applied again; however the focus this time was not on group trends, as described above, but rather on interpersonal variation within the late consecutive bilinguals. The assumption here was that although group trends may have been evidenced, some late consecutive bilingual migrants may have performed conversely to the group trends. As already described, in investigating such variation, the relationship between the L1 and

the L2 was initially examined in each participant. In other words, the question here was whether or not the selected phonetic elements evidenced merging in *each* bilingual migrant.

In the event that interpersonal variation was evidenced in the bilingual migrant group, some migrants potentially displaying the effects of first language attrition and others not, an analysis of predictor variables was undertaken. Here, the impact of age of arrival, length of residence and type and amount of contact with the German language in Canada on first language attrition was investigated.

Finally, intrapersonal variation was examined in the bilingual migrants to determine whether any potential merging (or lack of merging) was indeed a consistent occurrence in the speech of each bilingual.

This general form was adhered to for the analysis of each phonetic task (final lateral /l/, prenuclear tonal alignment and pitch range), which follow in the preceding chapters.

Chapter 4

L1 attrition of the lateral phoneme /l/ in German

4.1 Word final /l/ in German and English

In both German and English, the lateral phoneme /l/ is characterised by closure along the alveolar ridge and median line in the mouth. This allows for the breath stream to flow freely along the lowered sides of the tongue. In both languages, there is no stoppage of the air flow and no fricative noise in normal lateral production. As a result of this, the lateral phoneme /l/ has been classified as an approximant, given that it shares articulatory attributes of both consonants and vowels (see amongst others Neppert, 1999; Stevens, 2000; Hayward, 2000; Ladefoged, 2000; Scobbie and Wrench, 2003 for articulatory and acoustic descriptions of the lateral phoneme). .

However, both the articulatory production and the acoustic correlates of /l/ can vary between German and English. In particular, the dorsal region of the tongue differentiates lateral production in these languages. As will be discussed in this chapter, first language attrition in the domain of phonetics can be assessed on the basis of these differences.

In English, the back of the tongue is generally elevated during the realisation of word final laterals.¹ This raising creates what can be termed a ‘velarised’ lateral. Velarisation is reflected in the acoustic signal in a decrease in the frequency of the second formant, or F2 (Hayward, 2000 : p. 201; Kent and Read, 1996 : p. 140; Olive et al., 1993 : p. 207 and many more). When F2 frequency is low, the literature refers to a ‘dark’ /l/ (Gimson, 1989; Olive et al., 1993) which can be expressed by the phonetic symbol [ɫ].

¹It should again be emphasised here that ‘English’ refers to Canadian English. Studies which refer to the lateral phoneme in American English are assumed to hold true for Canadian English as well. This assumption is based on other studies, which indicate that the consonantal systems of Canadian and American English are very similar (Wells, 1982 : pp. 491 and 495).

In other English varieties, /l/ is not dark in all positions. Gimson (1989) differentiates between three main allophones in British English: 1. clear [l], with a relatively front vowel resonance predominantly in word initial position; 2. dark [l], with a relatively back vowel resonance in word final position; and 3. voiceless [l] most noticeably following accented, aspirated /p, k/. With reference to British English, he suggests that dark /l/ often has the effect of retracting and lowering slightly the articulation of a preceding front vowel. In the case of /i:/ + dark /l/ a central glide between the vowel and dark /l/ is often noticeable (Gimson, 1989). Other studies have shown that within British English there is a large degree of dialectal variation in /l/ production (Scobbie and Wrench, 2003; Carter and Local, 2007). However, it is generally accepted that in American (and Canadian) English there is less allophonic variation of /l/ than in British English. Wells (1982) clearly summarises that “Canadian /l/ is dark in all positions” (p. 495). Ladefoged and Maddieson (1996) elaborate that in American English word final /l/ may be more velarised than word initial /l/, but that both are characterised by a low F2 frequency (p. 361). Moreover, in their example, the glide from lateral to vowel in word initial position is shorter than from vowel to lateral in word final position. In the latter “the low F2 value is fully achieved before the consonantal occlusion begins” (p. 361). In other words, the elevation of the back of the tongue in word final [ɫ] may create a decrease in the frequency of F2 in the preceding vowel in English.

In Standard German, the back of the tongue is usually not elevated during the realisation of word final lateral (Moulton, 1970; Kufner, 1970; Wells, 1982). This flatter position of the back of the tongue is reflected in a higher F2 frequency, in comparison to [ɫ] of Canadian English. The phonetic symbol used to represent the realisation of the German lateral is [l]. When F2 is relatively high, which is generally the case in German, a ‘clear’ (Gimson, 1989 : p. 202) or ‘light’ /l/ is the preferred terminology (Olive et al., 1993 : pp. 204 - 216). Recasens (2004) states: “... the mean F2 for [l] is found at 1680 Hz in the case of male speakers of German... On the other hand the finding that dark [l] in the same string [ili] has a mean F2 across male speakers of American English (about 1000 Hz) indicates that [l] could be darker in the latter dialect versus the former” (pp. 594 - 595). Still, the high F2 frequency of [l] in German can be influenced by either regressive or progressive coarticulation (Neppert, 1999 : pp. 229, 242). If the neighbouring vowel of /l/ is velarised, for example in the case of /u/, a lower F2 frequency in the German phoneme /l/ is often the result. As discussed in the methodology section of this chapter, it is for this reason that the lateral analysis considered only word final lateral preceded by non-velarised vowels.

Although there has been much less research on the German than the English lateral, particularly with regard to regional variation, impressionistic observations suggest that

in some regional varieties, such as those of Cologne and Bavaria, dark /l/ is prevalent in German. Note Schirmunski's (1962) observation: "*Velarisiertes l* [ɫ] *begegnet ziemlich oft in den niederdeutschen Dialekten*"² (p. 370). Kohler (1995) additionally states with regard to German /l/ that "*im Rheinland tritt hingegen, vor allem final, Velarisierung auf*"³ (p. 165). Nevertheless, due to the fact that the regional varieties of the control participants were controlled in the present investigation, it is possible to generally contrast German /l/ with its English counterpart in examining potential first language attrition.

A constriction, or lack of constriction, in the back of the oral cavity may influence not only F2 in German and English, but potentially also the first formant, or F1, in the lateral segment (Neppert, 1999). If a constriction occurs towards the back of the oral cavity (as is the case in [ɫ]), F1 frequency may increase. Alternatively, if the constriction occurs in the front half of the oral cavity, the frequency of F1 tends to be lower. However, high F1 frequency also corresponds with a wider jaw angle, or a more open oral cavity, whereas a lower F1 represents a more narrow jaw angle. Indeed, it is often assumed that F1 frequency is a robust correlate of jaw angle. In other words, a high F1 frequency may be caused by both a wider jaw angle and closure towards the back of the mouth. In terms of dark and light /l/, this means that in the former realisation one may expect a higher F1 frequency than in the latter, as constriction occurs towards the back of the mouth in dark /l/.⁴ Recasens (2004) observes: "Dark [l] has been set in contrast with clear [l] based on well defined articulatory and acoustic properties, namely, the formation of a post-dorsal velar or pharyngeal constriction and active pre-dorsum lowering causing F2 to lower and F1 to raise" (p. 594).

Summarising, it is possible to say that in word final position the lateral generally displays a higher F1 and a lower F2 in English than in German. These differences are the focus of this part of the production analysis into first language attrition.

4.1.1 Hypotheses

Based on the information described in the preceding section, as well as that of Chapter 3, the following hypotheses were tested.

1. First set - control groups

- (a) A significantly lower F1 will occur in the lateral phoneme /l/ of the German control group than in the English control group.

²Translated, this means that in Low German dialects, [ɫ] occurs quite frequently.

³In English, this means that /l/ is often velarised by speakers from the Rhineland.

⁴An articulatory investigation would be necessary to ensure whether this was in fact not caused by a wider jaw angle.

- (b) A significantly higher F2 will occur in the lateral phoneme /l/ of the German control group than in the English control group.

2. Second set - first language attrition

- (a) A significantly higher F1 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech.
- (b) A significantly lower F2 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech.

3. Third set - merging effects

- (a) The F1 of the lateral phoneme /l/ will be the same in the bilinguals' German and English.
- (b) The F2 of the lateral phoneme /l/ will be the same in the bilinguals' German and English.

4.2 How was word final /l/ measured?

The following section describes how the lateral phoneme was presented, annotated and measured in German and English. These measurements allowed for a descriptive and statistical comparison of the lateral in both languages of the experimental and control groups.

4.2.1 Presentation

Initially, it is necessary to recall that the lateral task was the first phonetic task presented to the participants. It occurred after the language background questionnaire and it was followed by the tonal alignment task. It should also be emphasised that the German lateral task was presented to the participants in the German language half, and the English lateral task was presented in the English half. This was done in order to enhance the respective language modes of each language (Grosjean, 2001). The total duration of the English lateral task was slightly longer than its German equivalent, which was due to the fact that more tokens in the English language fulfilled the criteria discussed below. Each word was presented for 2.3 seconds in the PowerPoint™ presentation, at which point the next word

appeared automatically on the monitor. The participant said the word as soon as it popped up.

The German and English lateral tasks were divided into three approximately equal parts (Part I, Part II and Part III) with a break separating both Part I from II and Part II from III (please see appendices B.1 and B.2 for the entire word list in respectively German and English). Each of the two breaks in each language section had a duration of one minute. These breaks were included in the task because it was found that presenting the words together in a single session was too taxing for the participants, as previously mentioned on page 76. During the short breaks it was possible for the participants (and the interviewers) to change their posture and take a sip of water or apple juice. The total duration of the English section was just under 18 minutes, whereas that of the German section was just over 14 minutes.

In each language half, the lateral task commenced with a practice run. The purpose of the practice run was to familiarise the participant with the type of word which would be presented (monosyllabic), and the rhythm of the presentation. Eighteen fillers comprised this practice session. In each language half, words which were deemed as being somewhat culturally specific were chosen. For example, in the German session, one of the fillers was “*Quark*”, a type of yoghurt-like German cheese, which is not readily available in Canada. In the English half, one of the words was “logs”. This word was assumed to be more strongly associated with the Canadian province of British Columbia, where the forest industry plays a large role in the local economy, than with Germany. The objective of choosing these somewhat culturally specific words was again to support the monolingual mode of each language half.

Once the initial practice run was finished, the PowerPoint™ presentation indicated to the participant that Part I would commence. Both Part II and III were also preceded by practice runs, but these consisted of only six fillers each. The objective of these fillers was the same as that of the first practice run. Each filler in these practice runs was only presented once.

In Part I, II and III of each language half, all words were presented three times. The words in which the lateral was embedded were monosyllabic, but the number of phonemes in each word varied. As shown in the appendices, the original materials included words with the phoneme /r/, in addition to those containing the lateral phoneme /l/. It was the original intention to also perform a phonetic investigation of /r/, but further analysis revealed that due to a high degree of regional variation in the phoneme /r/ (particularly within the German control group), this was not possible. In German Part I, II and III, 28 fillers, 25 words containing /r/, and 28 words containing the lateral were presented. Again, each of these words was repeated three times (hence in total, respectively, 84, 75 and 84

times). In the original English lateral task materials, 29 fillers, 25 words containing /r/, and 52 words containing the lateral were presented. These too were presented three times each (hence in total, respectively, 84, 75 and 156 times). The fact that each word was elicited three times was considered appropriate given the fact that especially in German relatively few words fulfil the specified phonemic criteria, which will be discussed in more detail shortly.

These words were partly randomised in their respective languages using a pseudo random number generator that generated an evenly distributed set of (pseudo) random numbers. This script was written in MATLAB scripting language (m-File). “Partly” is emphasised because once the randomisation had taken place, 15 fillers were taken out of the total list. Five of these were placed at the beginning of Part I, five at the beginning of Part II and five at the beginning of Part III. This was the case for both the German and English halves and done to ensure that participants had enough time to warm-up. Fillers were taken out of the total list when there appeared to be filler clustering in the randomised list. For example, if four fillers occurred together, it would have been considered appropriate to take one of these fillers out and place it at the beginning of a part. In other words, only 69 fillers were actually randomised in each language.

4.2.2 Annotation

Word final /l/ was preceded by a high or mid-high front unrounded vowel (respectively, from this point on broadly transcribed as /i/ or /e/), which was in turn preceded by one or more consonants, dependent upon the word. The preference for high or mid-high front unrounded vowels to precede the final lateral was based on the finding that the German lateral is readily influenced by coarticulation, dependent upon the preceding and receding sound (Neppert, 1999 : pp. 229, 242). Given that the preceding vowel was already high to mid-high, velarisation of the final lateral due to preservative coarticulation in German speech was prevented. Similarly, because the lateral occurred in word final position, regressive coarticulation of /l/ was also prevented. This meant that if a higher F1 or a lower F2 was observed in German final /l/ this could not be attributed to neighbouring vowels. Alternatively, the effects of coarticulation could have been avoided by using words with medial lateral position, although there are not many words in English and German which fulfil this criterion and have the same syllabic length. Moreover, controlling for the effects of stress on lateral duration in both English and German may have been problematic (Lavoie, 2001).

Before F1 and F2 were acoustically measured in each word, all recordings were initially listened to. This was done in order to obtain an overall impression of each speaker’s

pronunciation. The auditory analysis was observed in relation to the acoustic data, and notes were made regarding the various (impressionistic) realisations of /l/ by each speaker. This global analysis of /l/ allowed for decisions to be made regarding the specific acoustic analysis, which are to be discussed shortly.

After this global analysis, the annotation of significant acoustic events in /l/ proceeded in the following manner. Firstly, the end of the voicing in the word final lateral was manually marked using Praat. This marker was labelled END. The end of voicing was characterised in the spectrogram by an abrupt drop in intensity and a ceasing of regular periodic phonation. In many cases, the voice bar continued after the drop in intensity and ceasing of glottal pulses, but the voice bar was not the predominant criterion for marking the end of voicing. The preference was to place the marker END according to the two specified criteria (drop of intensity and ceasing of regular periodic phonation), as is displayed in Figure 4.1. In some tokens a steep F1 frequency fall occurred slightly before the onset of devoicing. In these tokens the preference was to place the marker END at the onset of the steep F1 frequency fall, as displayed in Figure 4.2. In these cases, the marker END was still before the onset of devoicing. It was the aim to place the marker END where no voicing followed, but no exhalation preceded the marker.

After the manual insertion of the marker END, a Praat script automated the insertion of another marker 30 ms prior to the initial marker (a description of the settings in Praat follows). This marker was labelled -30ms, as is displayed in Figure 4.1 and Figure 4.2. It was at this point where the frequencies of F1 and F2 were measured by hand. Through an auditory and acoustic analysis, it was ensured that the marker -30ms was in fact within the lateral. Acoustically, it was sometimes possible to verify that the marker occurred after the rise in F3, characteristic of an /l/ spectrogram (Stevens, 2000), although this was not always the case. The onset of the final lateral was not marked because a categorical distinction between the preceding vowel and the following lateral based on the acoustic signal was problematic. This was due to the transitional phase between the vowel and the lateral, which is continuous, rather than abrupt. The challenge for the annotation of /l/ was that consistent criteria, which can be applied not merely across speakers but also across languages, were necessary. For example, it would not have been possible to define the lateral on the basis of an F2 frequency fall because in some tokens the F2 frequency fall began in the vowel, as similarly cited by Ladefoged and Maddieson (1996: p. 361). In other tokens, the F2 fall began in the lateral, whereas in still other tokens, there was no fall. Although Stevens (2003) mentions that a general characteristic of laterals is a high F3 frequency, this was not observed in all tokens and could not be used as a standard point of measurement. For example, in Figure 4.1 there is a fall in F3 frequency during /l/, whereas in Figure 4.2, F3 frequency increases. In other words, there was no single

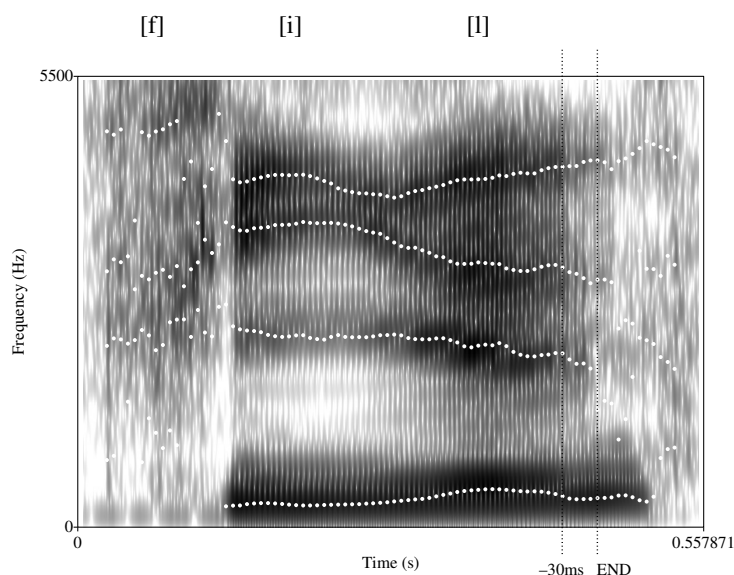


Figure 4.1: The word ‘*viel*’ as spoken by a female German control participant. The relatively straight F1 and F2 contours, continuing from the preceding [i] into [l] are characteristic of a ‘light’ German lateral. F1 and F2 were measured semi-automatically at the first marker, labelled -30 ms in this figure.

time point in the acoustic signal which was able to be used to characterise the beginning of the lateral in all tokens.

Instead, global perceptual criteria were used to ensure that only laterals which were longer than 30 ms were included in the analysis. This is to say that the lateral was listened to in order to determine whether or not it was just that. In doing so, approximately 10-30 ms prior to the lateral was listened to in addition to the 30 ms after the -30ms marker. Given that speakers had ample time to produce each word, which were presented individually, speech was in general quite clear and not rushed. This meant, for the most part, that individual segments were relatively long in duration, in comparison to faster speech. In most cases, it could be perceptually verified that the marker -30ms was within the lateral by listening to approximately the final 50 ms phase at the end of the word. This observational data corresponds to the durational study by Lavoie (2001) in which word lists were presented to participants. Here it was found that in stressed position /l/ had an average duration of 70ms. The interpersonal variation in duration of /l/ in her American English participants ranged from 36 ms at the shortest to 159 ms at the longest.

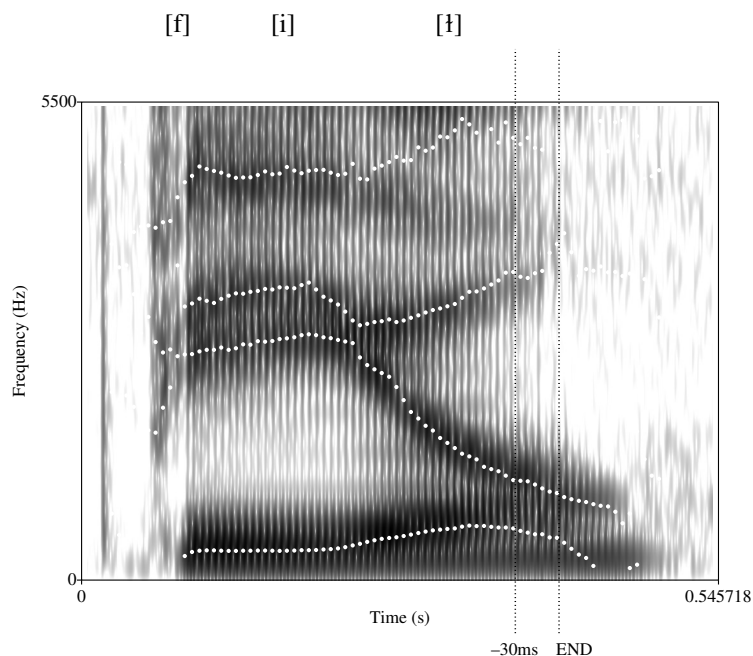


Figure 4.2: The word ‘feel’ as spoken by a female English control participant. The relatively high F1 and low F2 in the ‘dark’ lateral, are noticeable. Note that the glide between [i] and [ɫ] has not been transcribed. F1 and F2 were measured semi-automatically at the first marker, labelled -30 ms in this figure.

In those cases in which doubt arose that the marker -30ms was potentially not inside the lateral, the token was excluded. For example, during the global perceptual analysis, it was observed that laterals which were preceded by the lax variants of /i/ and /e/ (which were originally included in the materials, for example in the words ‘Fell’ and ‘fell’) were likewise shorter than their counterparts preceded by the longer vowels of /i/ and /e/. This resulted in these words which contained the lax vowels being excluded from the analysis. However, based on the global perceptual analysis, the impression was that most laterals which were included were rarely less than 50 ms and many over 70 ms in duration.

Summarising, as documented in tables 4.1 and 4.2, only long high and mid-high front unrounded vowels (broadly transcribed as /i/ and /e/) preceded the word final lateral. In the German section, 8 laterals preceded by /i:/ and three laterals preceded by /e:/ were analysed. In the English section, 16 laterals preceded by /i/ and 13 laterals preceded by /e/ were included, although particularly in English a diphthong was realised before the

lateral. Although using real words meant that fewer tokens were available, the fact that real words are more representative of normal language use, as well as that they were more likely to enhance the monolingual mode in each language (Grosjean, 2001), made using them more advantageous than nonsense words.

German words with final lateral	English translation
Preceded by /i/	
viel	a lot, many
Stiel	stem
Kiel	city in northern Germany
Nil	river Nile
Ziel	goal
Siel	sluice
Spiel	game
Priel	tidal creak
Preceded by /e/	
Hehl	secret
Kehl	guttural (compound)
Fehl	blemish

Table 4.1: The words used in the German lateral analysis and their English translations.

4.2.3 Measuring word final /l/

Once the measuring point had been determined, the actual extraction of F1 and F2 occurred. The semi-automatic extraction process allowed for visual cross-validation within each token. This ensured that the automatically extracted F1 and F2 were in fact plausible. Particularly in the case of dark /l/, in which F1 and F2 are close together, the automatic formant extraction process often finds only one formant, resulting in F3 being reported as F2. In such cases, the Praat settings were adjusted for the individual token. A description of the standard settings as well as those which were adjusted follows.

The specific command used to extract formants in Praat was Sound : To Formant (burg). This command uses linear predictive coding (LPC) to determine the contour of formants. LPC is based on equations which predict the amplitude of the waveform at any particular moment in time on the basis of what occurred beforehand (Hayward, 2000). The particular Burg algorithm implemented by this command in Praat is that of Press et al. (1992). As recommended in the Praat guidelines, the following arguments were specified for formant extraction:

- Window length : specifies the duration of the window in which the formant analysis occurs. This was set to 25 ms.

English words with final lateral	
Preceded by /i/	Preceded by /e/
heal	male
eel	mail
spiel	kale
veal	jail
real	sail
heel	bale
steal	nail
teal	fail
peal	tail
meal	gale
feel	rail
zeal	whale
deal	vale
seal	
kneel	
wheel	

Table 4.2: The words used in the English lateral analysis.

- Maximum formant : the maximum frequency of the formant search range in Hertz (Hz); 5500 Hz was chosen for adult females and 5000 Hz for adult males.
- Maximum number of formants : the maximum amount of formants which are extracted. Generally, five formants per frame were extracted; however, because the F1 and the F2 were often very close together in dark /l/'s, in order to prevent only one formant being found in these cases, the maximum number of formants was sometimes changed to four.
- Time step : the time between the centres of consecutive analysis frames (seconds). The time step was set to 0.0 (the standard), so Praat used a time step that is equal to 25% of the analysis window length, 6.25 ms.
- Pre-emphasis : the +3 dB point for an inverted low-pass filter with a slope of +6 dB/octave (Hz). This value was set at 50 Hz, which meant that frequencies below 50 Hz were not enhanced, frequencies around 100 Hz were amplified by 6 dB, frequencies around 200 Hz are amplified by 12 dB, and so forth. This ensured a flatter spectrum, as vowel spectra tend to fall by 6 dB per octave, thereby enhancing the formant analysis.

Based on these parameters, F1 and F2 were determined using the command Formant Listing. When these formant frequencies corresponded to the visual analysis, they were

extracted. In other words, for each target word, F1 and F2 frequencies were measured individually using a semi-automated procedure. This created a list of formant frequencies for all of the words which were produced for each speaker. This list for each speaker was transferred to an Excel document. The tokens were divided into two separate categories dependent upon the preceding vowel. Statistical analyses were performed separately for each category and comparisons were made across groups in order to investigate the hypotheses stated above in Section 4.1.1. Again, the primary aim in this analysis was to determine whether there was a difference between the German lateral production of the experimental group and the German control group. The secondary aim was to examine whether there was a relationship between the production of German and English laterals in the bilingual group.

4.3 Results

In this section, group analyses of the production of lateral phoneme /l/ are initially presented. These commence with the group results for lateral phoneme /l/ when preceded by the high front unrounded vowel, /i/. Thereafter, the group results for /l/ when preceded by the mid-high front unrounded vowel, /e/, are presented. In each of these sections, the F1 frequency analysis precedes the F2 frequency analysis. Men and women are presented separately, given that formant frequencies are a function of anatomical differences as well as vocal tract configuration. After the group analyses, interpersonal variation in the late consecutive bilinguals is examined. Here the focus is specifically on variation in the lateral phoneme /l/ in the L1 and the L2 of the bilinguals. Subsequently, an investigation into the impact of the previously discussed predictor variables (age of arrival, length of residence and amount and type of language contact with German) is documented. Thereafter, intrapersonal variation in the production of /l/ is examined. Finally, the consequences of the results of this segmental analysis are considered in the discussion.

4.3.1 /l/ preceded by high front vowel

The focus of the present section was on the production of the lateral phoneme /l/ when preceded by the high front unrounded vowel /i/. The main objective of this analysis was to determine whether there was a difference between the German control group and the German of the late consecutive bilingual migrants in the production of this phoneme. First language attrition was assumed in the case that there was a significant difference between the production of this phoneme in these two groups.

In order to determine whether the frequencies of F1 and F2 of the German bilinguals

were different from the German monolinguals, it was first necessary to ensure that the control groups differed from one another. A further objective was to investigate whether the bilingual migrants performed similarly, as a group, in both their L1 and L2. Accordingly, with regard to the final lateral /l/ preceded by the high front vowel, /i/, the following hypotheses were tested:

- Hypothesis 1a (a significantly lower F1 will occur in the lateral phoneme /l/ of the German control group than in the English control group);
- Hypothesis 1b (a significantly higher F2 will occur in the lateral phoneme /l/ of the German control group than in the English control group);
- Hypothesis 2a (a significantly higher F1 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech); and
- Hypothesis 2b (a significantly lower F2 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech).

One-way ANOVAs were used to investigate these hypotheses. These ANOVAs tested the effect of group (German monolinguals, English monolinguals and bilinguals in German) on the dependent variable of F1 and F2. All tokens of the final lateral /l/ preceded by the high front vowel /i/ were included in these tests. This was done instead of using an averaged token of F1 and F2 for each participant. Arguably, including all tokens in these tests may have increased the likelihood of a Type I error, or finding an effect when in fact there was none (see, for example, Field, 2005 : p. 31). However, it was considered an advantage to use all tokens in this group analysis for two reasons.

On the one hand, including all tokens decreased the likelihood of a Type II error (hence not finding an effect when in fact there was one). Given that the groups were divided according to sex in the present analysis, if averages had been used, the degrees of freedom for some of the individual tests would have been rather small. In such cases, it is very possible that no effect would have been found when in fact there was one.

On the other hand, including all tokens more adequately represented any potential variability within the tokens of the bilingual speakers. In other words, it was not considered to be the case that each token which went into these ANOVAs was more-or-less an exact replicate of the other tokens from the same speaker, which indeed would have inflated the results. Using all tokens therefore more adequately accounted for variability within individual speakers.

In these ANOVAs, one-tailed significance was reported because the hypotheses (in sets one and two) specified a directional effect.

Finally, unless otherwise stated, assumptions for ANOVAs were verified for each dependent variable, such as normal distributions and homogeneity of variance. MANOVAs were not conducted on the dependent variables (F1 and F2) because the assumption of homogeneity of covariance matrices, or the assumption that the correlation between any of the two dependent variables must be roughly equal, was violated (Field, 2005 : p. 592). For example, there was a positive correlation between F1 and F2 in the lateral phoneme /l/ as measured after /i/ in the German females, $r = .44$, $p < .0001$, as well as in the English females, $r = .36$, $p < .0001$; whilst there were negative correlations between these same dependent variables in the German of the female bilinguals, $r = -.19$, $p < .01$ as well as in their English, $r = -.52$, $p < .0001$. The same opposing trends were revealed between F1 and F2 in the lateral phoneme /l/ as measured after /e/. Again, in the female control groups there were positive correlations between F1 and F2, whilst in the female experimental group there were negative correlations in both their German and English. In these latter tests, however, only the English data reached significance, which was very likely a function of the smaller amount of tokens for /l/ after /e/ for the German experiment. These results are interesting in their own right, yet the point of presenting them at this point is to justify the use of ANOVAs over MANOVAs for the statistical analysis. They will be approached in the discussion of this chapter again.

Dependent t-tests were conducted in order to investigate merging effects in the bilingual participants. Here, merging is considered to be the realisation of one lateral phoneme /l/ both in German and English, rather than two distinct phonemes in each of these languages. This parametric test is used to examine situations in which there are two sets of scores from the same participants. In contrast to the testing of the first and second hypothesis sets, two-tailed significance was reported when testing Hypothesis 3a and 3b (as listed below) because no directional effect was predicted. Given that the bilingual participants were measured twice (in their German L1 and in their English L2), this test was therefore appropriate in investigating the following hypotheses:

- Hypothesis 3a (the F1 of the lateral phoneme /l/ will be the same in the bilinguals' German and English); and
- Hypothesis 3b (the F2 of the lateral phoneme /l/ will be the same in the bilinguals' German and English).

The above statistical methodology was applied to all group analyses for the lateral phoneme /l/, unless reported otherwise.

In Table 4.3, the female mean F1 and F2 frequencies in the lateral phoneme /l/ when preceded by the high vowel /i/ are reported. These averaged group results suggest that the German monolingual females had a lower F1 (348 Hz) and a higher F2 (1864 Hz) than the English monolingual females (respectively, 549 Hz and 1061 Hz). Table 4.3 also documents the bilingual females' results. On average, the bilingual women had an F1 frequency which was intermediate to the monolingual female norm. In their German, F1 averaged to 429 Hz and in their English to 506 Hz. The F2 frequency in their German was closer to the German monolingual norm, averaging to 1824 Hz, whereas in English their F2 average was 1396 Hz, which was slightly higher than the English monolingual norm.

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
F1 (Hz)	348.49	41.99	428.59	84.16	505.78	112.98	548.66	81.82
F2 (Hz)	1863.56	197.47	1823.89	228.24	1396.25	275.61	1061.14	146.07

Table 4.3: Female F1 and F2 (Hz) in lateral phoneme /l/ preceded by the high front vowel /i/. Mean and standard deviations (Stdev) from all tokens in each group.

In Figure 4.3, a bar chart of the mean F1 frequency of females in the lateral phoneme /l/ (after /i/) is displayed. It was this F1 which was investigated as the dependent variable in the first one-way ANOVA. In the analysis up to this ANOVA, it was revealed that the Levene's test was significant. This suggested that the assumption of equality of variances was violated, which was quite possibly a side-effect of the relative high power of the test (Field, 2005). For this reason, due to the relative robustness of ANOVAs, the parametric ANOVA was maintained, and the Brown-Forsythe F was reported (consult, again, Field, 2005 for more information on violations of assumptions of ANOVAs). Similarly, for subsequent tests which indicated that the Levene's test was significant, the Brown-Forsythe F was reported.

This model was significant, revealing that there was a highly significant effect of group (female German control, female English control and bilingual females in their German) on the dependent variable of F1 frequency, $F(2,467) = 444.68$, $p < .0001$. The planned contrasts indicated that, as hypothesised, the F1 in the lateral phoneme /l/ of the German females was significantly lower than of the English females, $t(443) = 34.31$, $p < .0001$ (one-tailed), and that F1 in the German of the bilingual females was significantly higher than in the German females $t(244) = 11.01$, $p < .0001$ (one-tailed). The result of this latter planned contrast was an indication of first language attrition in the production of the lateral phoneme /l/ in the bilingual migrant females. Finally, there was a highly significant

difference between the F1 frequency of the bilingual females in their German and in their English, $t(95) = -17.92$, $p < .0001$ which pointed towards a lack of merging in the lateral phoneme /l/ after /i/. Viewed in conjunction with the result of the second planned contrast, this suggested that as a group, although the bilingual females evidenced first language attrition in the lateral phoneme /l/, they maintained distinct phonemes in their German and English (at this point at least in terms of the F1 frequency).

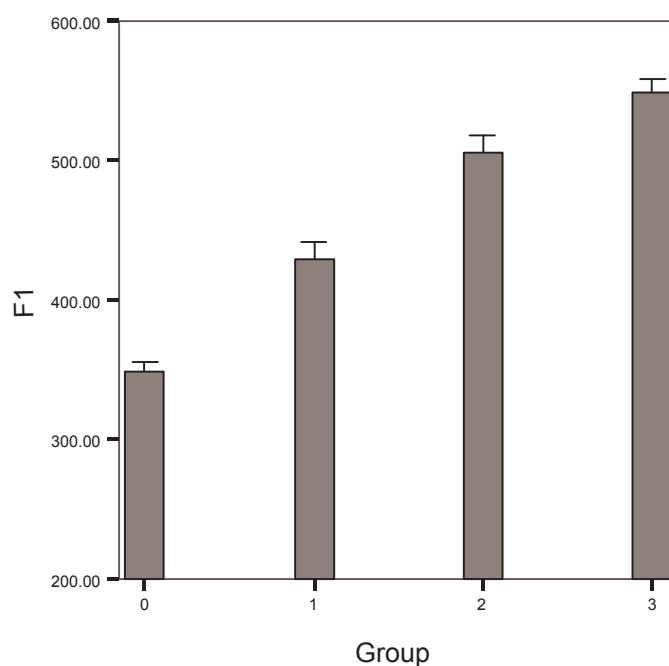


Figure 4.3: Bar chart of the mean F1 of females in /l/ after /i/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

Figure 4.4 displays the F2 frequency of the females in the lateral phoneme /l/ in the same position. When visually compared with Figure 4.3, it stands out that the F2 frequency of the bilingual females in their German is closer to the F2 frequency of the German monolinguals than was the case for the F1 frequency. Nevertheless, there was a highly significant effect of group on the dependent variable of F2, $F(2,433) = 1208.74$, $p < .0001$ (the Brown-Forsythe F is again reported, see page 109 for justification). Planned contrasts indicated that, as hypothesised, the German females had a significantly higher F2 than the English females, $t(273) = -45.70$, $p < .0001$ (one-tailed). However, there was no significant difference between F2 in the German bilingual females and in the German female control group, $t(325) = -1.70$, $p = .09$ (one-tailed), which contrasted to

the F1 analysis. This suggested that first language attrition was not evidenced in the F2 frequency of the lateral phoneme /l/ after /i/ in the female migrants. Finally, there was once again a significant difference between the languages of the bilingual females, $t(95) = 15.46$, $p < .0001$, which supported that as a group distinct phonemes were maintained in the L1 and L2.

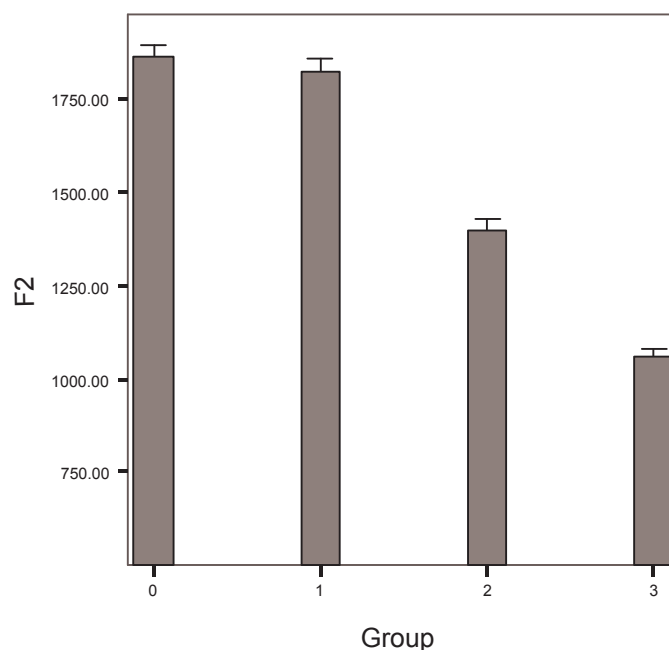


Figure 4.4: Bar chart of the mean F2 of females in /l/ after /i/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

In Table 4.4, the corresponding male results are reported for the F1 and F2 frequency in the lateral phoneme /l/ when preceded by the high vowel /i/. Similar to the female results (see Table 4.3), the male German monolingual males had a lower F1 (244 Hz) and higher F2 (1551 Hz) frequency than did the English monolingual males (respectively 470 and 891 Hz). These descriptive results also suggested that the bilingual males' F1 and F2 frequencies were intermediate to those of the monolingual males. In their German, F1 frequency was an average of 390 Hz, whilst in their English it was 443 Hz. The F2 frequency in their native German had a mean of 1344 Hz, and in their English the mean was 988 Hz.

Figure 4.5 displays group differences in F1 of the final lateral /l/ for the male participants. There was a highly significant effect of group (male German control, male English

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
F1 (Hz)	244.18	31.76	389.93	43.17	442.87	50.85	469.51	74.71
F2 (Hz)	1551.19	72.05	1343.72	420.73	988.21	184.77	891.41	82.73

Table 4.4: Male F1 and F2 (Hz) in lateral phoneme /l/ preceded by the high front vowel /i/. Mean and standard deviations (Stdev) from all tokens in each group.

control and bilingual males in their German) on F1 in this phoneme, $F(2,218) = 421.77$, $p < .0001$ (the Brown-Forsythe F is reported, see page 109). The planned contrasts indicated that F1 in the German males was significantly lower than in the English males, $t(157) = 27.90$, $p < .0001$ (one-tailed), and that F1 in the German of the bilingual men was significantly higher than in the German males $t(130) = 23.07$, $p < .0001$ (one-tailed). This meant that the results for the male and the female participants were similar, both revealing first language attrition as evidenced in the frequency of F1 of the lateral phoneme /l/ when preceded by /i/. Moreover, as was the case with the female bilinguals, F1 in /l/ for the male bilinguals significantly differed in their L1 and L2, $t(38) = -11.95$, $p < .0001$, suggesting that no merging of these phonemes had occurred.

In Figure 4.6 the group differences in the F2 frequency of the same phoneme in the same position are displayed for males. Again, a highly significant effect of group was revealed, $F(2,80) = 154.43$, $p < .0001$ (the Brown-Forsythe F is reported, see page 109). As was the case for the female analysis, the German males had a significantly higher F2 frequency than the English males, $t(166) = -56.81$, $p < .0001$ (one-tailed). However, in contrast to the group analysis of the females, the bilingual males also had a significantly lower F2 than did the German males, $t(75) = -4.12$, $p < .0001$ (one-tailed). This meant that attritional effects were evidenced in the F2 frequency of the lateral phoneme /l/ in the male production, whilst not in the female production. Finally, there was once again a significant difference between the F2 frequency of the German and English final lateral /l/ on the part of the bilingual males, $t(38) = 8.16$, $p < .0001$, indicating language specificity in their production of /l/.

Summarising the results for the group analyses of the production of the lateral phoneme /l/ when preceded by the high front vowel /i/, Hypothesis 1a and 1b were verified on all accounts. This is to say that in both the men and the women, a significantly lower F1 frequency and a significantly higher F2 frequency occurred in the German monolingual control group than in the English monolingual control group. In other words, for /l/ after /i/, English participants realised a “dark” /l/ whilst German participants realised a “light” /l/.

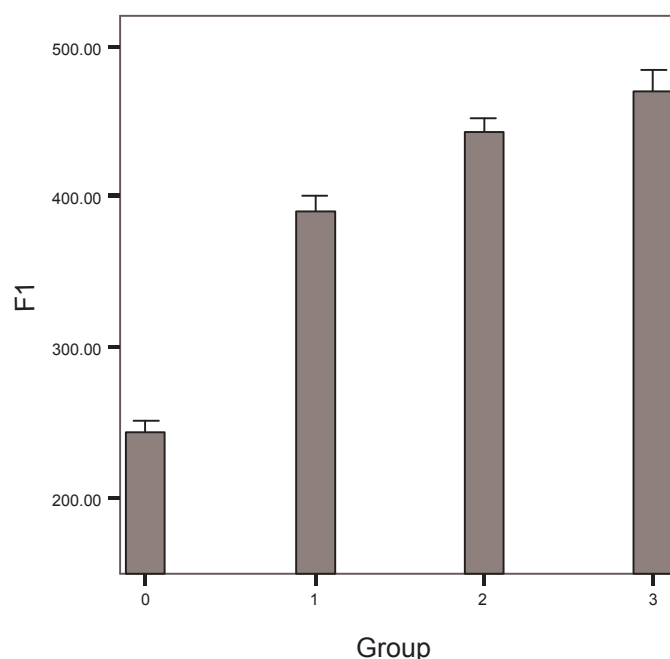


Figure 4.5: Bar chart of the mean F1 of males in /l/ after /i/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

Hypothesis 2a was similarly confirmed for both women and men. The frequency of F1 in the lateral phoneme /l/ when preceded by /i/ was significantly higher in the German of both the female and male bilinguals than in the respective German control group. This suggested that first language attrition was revealed in a higher F1 frequency.

On the other hand, Hypothesis 2b was only confirmed for the male bilinguals, but not for the female bilinguals. The F2 frequency was significantly lower in the German of the bilingual males than in the German monolingual males, whilst the same was not the case for the bilingual females. This suggests that, as groups, attritional effects were evidenced in the F2 frequency of the male migrants, but not in the females.

Finally, Hypothesis 3a was not confirmed; no merging of the German and English lateral phoneme /l/ occurred in the L1 and L2 speech of the bilinguals in the group analyses. In contrast, it appeared that the bilinguals maintained, or achieved, rather distinct phonemes in German and English.

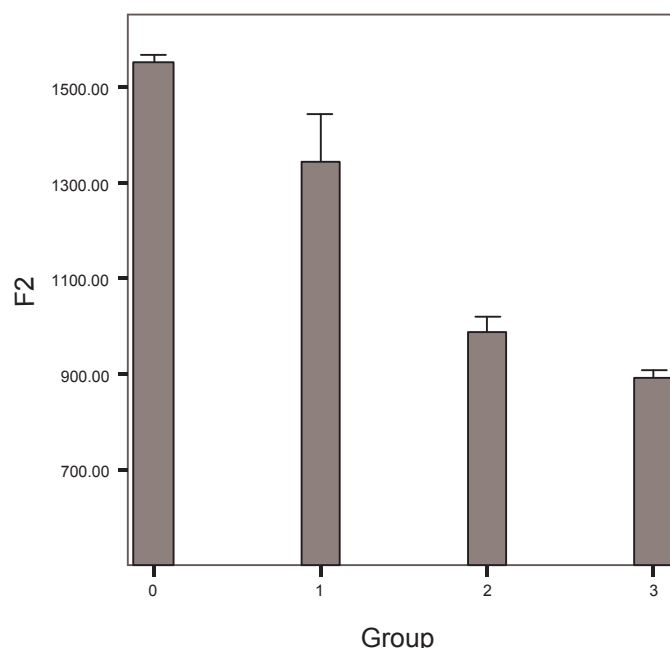


Figure 4.6: Bar chart of the mean F2 of males in /l/ after /i/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

4.3.2 /l/ preceded by mid-high front vowel

The present section documents the production of the final lateral /l/ when preceded by the mid-high front unrounded vowel /e/. As was the case for the previous analysis of /l/ after /i/, the main objective of this section was to investigate differences between the German control group and the bilingual migrants in their German. In order to do so, establishing differences between the German and English control groups was initially necessary. Accordingly, the hypotheses were the same as in the previous section, although specific to the final lateral /l/ when preceded by the mid-high front vowel /e/:

- Hypothesis 1a (a significantly lower F1 will occur in the lateral phoneme /l/ of the German control group than in the English control group);
- Hypothesis 1b (a significantly higher F2 will occur in the lateral phoneme /l/ of the German control group than in the English control group);
- Hypothesis 2a (a significantly higher F1 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech); and

- Hypothesis 2b (a significantly lower F2 will occur in the lateral phoneme /l/ in the native German speech of the bilingual migrants than in the German monolingual control group's speech).

The statistical analyses for these tests was the same as previously documented for the investigation into the production of word final /l/ preceded by the high front vowel /i/ (see page 107). In other words, one-way ANOVAs were again performed which tested the effect of group (German monolinguals, English monolinguals and bilinguals in German) on the dependent variable of either F1 or F2.

As was the case in the previous results section, a parametric dependent t-test was used to investigate the following hypotheses in the bilingual participants:

- Hypothesis 3a (the F1 of the lateral phoneme /l/ will be the same in the bilinguals' German and English); and
- Hypothesis 3b (the F2 of the lateral phoneme /l/ will be the same in the bilinguals' German and English).

In Table 4.5, the female averaged results of F1 and F2 for final lateral /l/ preceded by the mid-high front vowel /e/ are reported. In general, a similar pattern is evidenced in this table, in comparison to the previously discussed Table 4.3. The mean frequency of F1 (364 Hz) was again noticeably lower and the mean frequency of F2 (1836 Hz) strikingly higher in the German females than in the English females (respectively 573 Hz and 1059 Hz). Moreover, the bilingual females displayed an intermediate F1 frequency: in their German 449 Hz and in their English 546 Hz. In contrast, their F2 frequency in their German (1844 Hz) was approximately the same as that of the German female control group, whilst the F2 frequency in their English (1405 Hz) was intermediate to the control groups.

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
F1 (Hz)	363.84	46.55	448.91	82.92	545.53	117.04	573.07	90.81
F2 (Hz)	1835.89	167.80	1844.00	221.49	1404.75	284.15	1059.39	153.14

Table 4.5: Female F1 and F2 (Hz) in lateral phoneme /l/ preceded by the mid-high front vowel /e/. Mean and standard deviations (Stdev) from all tokens in each group.

In Figure 4.7, the mean F1 frequency of the lateral phoneme /l/ when preceded by /e/ for the females is displayed. The one-way ANOVA which investigated the effect of

group (female German control, female English control and bilingual females in their German) on the dependent variable of F1 was significant, $F(2,180) = 236.98$, $p < .0001$ (the Brown-Forsythe F is reported, consult page 109). As hypothesised, the planned contrasts indicated that F1 frequency in the German females was significantly lower than in the English females, $t(191) = 24.77$, $p < .0001$ (one-tailed), and that F1 frequency in the German of the bilinguals was significantly higher than in the German females $t(100) = 7.12$, $p < .0001$ (one-tailed). These results were similar to that of the investigation into the frequency of F1 in /l/ after /i/, confirming both differences between the control groups as well as attritional effects. Again, there was a highly significant difference between the languages of the bilinguals, $t(21) = -12.63$, $p < .0001$ which affirmed the lack of merging.

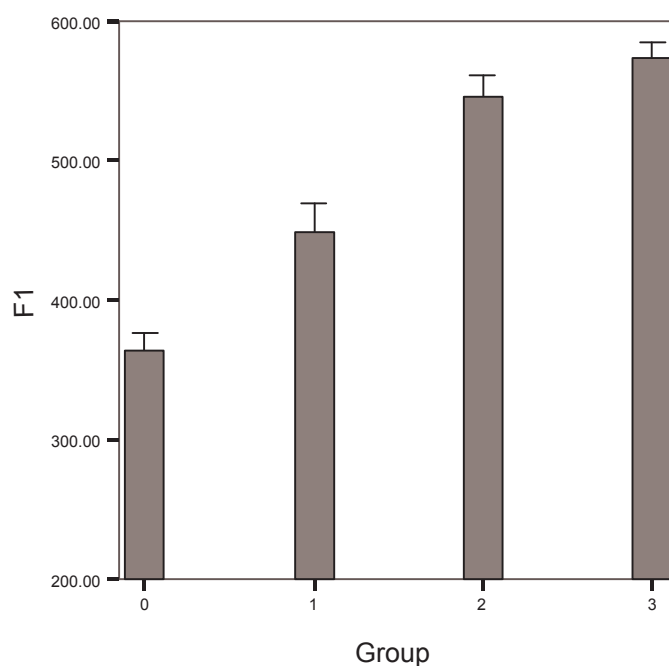


Figure 4.7: Bar chart of the mean F1 of females in /l/ after /e/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

In Figure 4.8, the F2 frequency of the lateral phoneme /l/ after /e/ in the female participants is displayed. This model was also significant, revealing that there was a strong effect of group on the dependent variable of F2, $F(2,855) = 236.98$, $p < .0001$. The planned contrasts indicated that F1 in the German women was significantly lower than in the English women, $t(352) = -31.75$, $p < .0001$ (one-tailed). However, just as had been the case in the previous analysis of F2 in /l/ after the high vowel /i/, there was no significant

difference between the German monolingual females and the bilingual females in their German in the F2 of /l/ after the mid-high vowel, /e/, $t(352) = 0.27$, $p < .79$ (one-tailed). These results suggested greater stability again regarding first language attrition in the F2 frequency of the lateral phoneme /l/ than in the F1 frequency. The final group test for the female bilinguals indicated again that the F2 frequency of the lateral phoneme /l/ after /e/ in the female bilinguals had not been merged, $t(21) = 4.68$, $< .0001$.

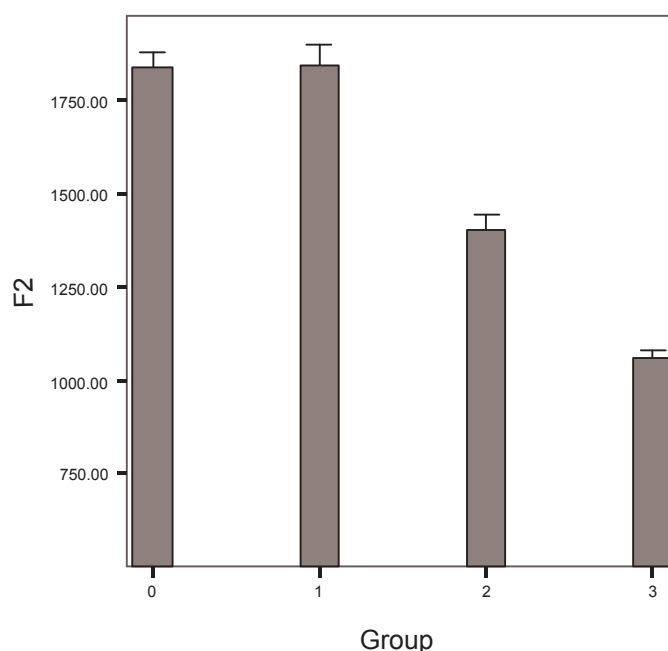


Figure 4.8: Bar chart of the mean F2 of females in /l/ after /e/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

In Table 4.6, the male averaged results of F1 and F2 frequencies for the lateral phoneme /l/ preceded by the mid-high front vowel /e/ are reported. As displayed, the German males had a mean F1 frequency of 287 Hz and a mean F2 frequency of 1525 Hz. In contrast, the mean F1 frequency of the English males was noticeably higher at 486 Hz, and their mean F2 frequency again lower, at 897 Hz. Moreover, the bilingual F1 and F2 frequencies appeared to be intermediate to the monolingual males'. In their German, the mean F1 frequency of /l/ after /e/ was 424 Hz, whilst in their English it was similar to the monolingual English male norm at 483 Hz. The mean frequency of F2 in /l/ in this position was 1376 Hz in the bilingual males' German, and in their English it was 976 Hz.

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
F1 (Hz)	286.67	39.21	424.44	46.37	482.68	52.69	486.40	80.55
F2 (Hz)	1524.96	77.62	1376.07	459.67	975.75	152.55	896.77	92.32

Table 4.6: Male F1 and F2 (Hz) in lateral phoneme /l/ preceded by the mid-high front vowel /e/. Mean and standard deviations (Stdev) from all tokens in each group.

In Figure 4.9, the F1 frequency of the lateral phoneme /l/ after /e/, as produced by the male participants, is comparatively displayed. When this dependent variable was investigated in one-way ANOVAs, it was revealed that there was a highly significant effect of group (German control males, English control males and bilingual males in their German), $F(2,181) = 155.20$, $p < .0001$ (the Brown-Forsythe F is reported, consult page 109). As was the case for the female participants, the planned contrasts indicated that F1 in the /l/ of the German males was significantly lower than in the /l/ of English men, $t(91) = 17.69$, $p < .0001$ (one-tailed). Moreover, the F1 frequency of /l/ in the German of the bilingual males was significantly higher than in the German control males $t(51) = 11.79$, $p < .0001$ (one-tailed). When the languages of the bilingual males were compared, the results revealed that there was a significant difference between F1 of the German and English lateral /l/, $t(8) = -14.68$, $p < .0001$.

In Figure 4.10, the F2 frequency of /l/ after /e/ is comparatively displayed for the male participants. Once again, the effect of group on the dependent variable of F2 was highly significant, $F(2,28) = 59.53$, $p < .0001$ (the Brown-Forsythe F is reported, consult page 109) and again the planned contrasts indicated that the F2 was significantly higher in the German males than in the English males, $t(50) = -35.35$, $p < .0001$ (one-tailed). However, the F2 frequency of /l/ after /e/ on the part of the bilinguals (in their German) was not significantly higher than in the same /l/ of the German control group $t(27) = -1.66$, $p = .108$ (one-tailed). This therefore contrasted to the investigation of the lateral /l/ when preceded by /i/, for which a significant difference had been reported (perhaps due to the smaller amount of tokens for /l/ after /e/ in the German part of the lateral experiment). The final test investigating potential merging of the lateral phoneme /l/ in the L1 and the L2 of the bilingual males indicated that the F2 frequency in German and English significantly differed, $t(8) = 22.58$, $p < .0001$.

Reiterating the results for the group analyses of the production of lateral /l/ (when preceded by the mid-high vowel /e/), Hypothesis 1a and 1b were verified for both men and women. In other words, a significantly lower F1 frequency and a significantly higher F2 frequency occurred in the German monolinguals than in the English monolinguals.

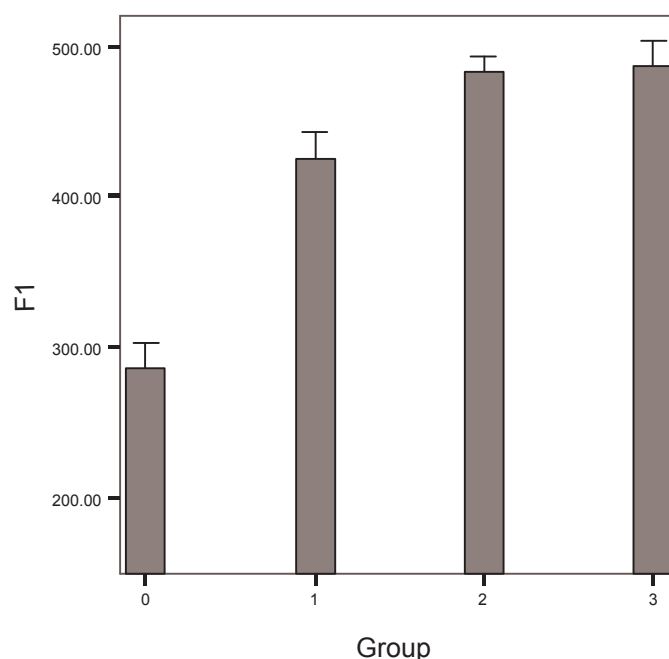


Figure 4.9: Bar chart of the mean F1 of males in /l/ after /e/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

Once again, English participants realised a “dark” /l/ whilst German participants realised a “light” /l/. These results confirmed those of the previous group analyses.

As was the case in the investigation of /l/ after /i/, Hypothesis 2a was also substantiated for both women and men. This is to say that the frequency of F1 in the lateral phoneme /l/ when preceded by the mid-high vowel /e/ was significantly higher in the German of both the female and male bilinguals than in the respective German control groups. These results were again suggestive of first language attrition in the production of the lateral phoneme /l/ on the part of the late consecutive bilingual migrants.

On the other hand, Hypothesis 2b was not confirmed for both the males and the females. Indeed, there were no significant differences between the bilingual migrants and the German control group in the frequency of F2 in the lateral phoneme /l/ when preceded by the mid-high vowel /e/. Viewed in light of the F1 frequency group analysis, this suggests first language attrition in the /l/ phoneme was more clearly evidenced in the frequency of F1 than in that of F2.

Finally, Hypothesis 3a was again not confirmed in any of the tests. In other words, in the group analyses it appeared that the late consecutive bilingual migrants had distinct

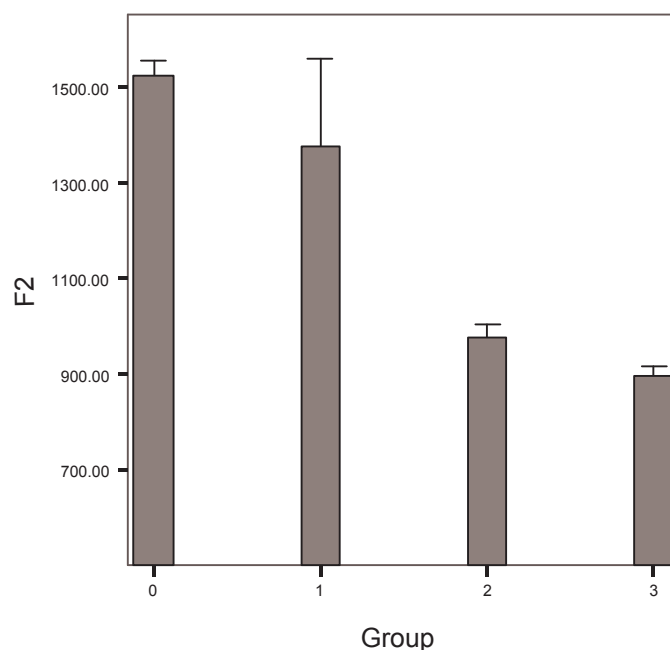


Figure 4.10: Bar chart of the mean F2 of males in /l/ after /e/ for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

variants of the lateral phoneme /l/ when measured after /e/ in their German and English. This confirmed that although first language attrition was evidenced in their /l/ phoneme, this was not indicative of merging of the L1 and L2.

4.3.3 Bilingual variation in word final /l/

The previous analyses examined group trends and did not differentiate between individual bilinguals. In the present section, closer examination was directed towards bilingual variation in the production of final lateral /l/. It was of interest to examine whether the late consecutive bilingual migrants may have differed with regard to the language specificity of their L1 and L2. In other words, it was the objective of this section to investigate to what extent the bilinguals produced the lateral phoneme /l/ (in their German and English) within the monolingual norms of German and English. Given the order of the previous group analyses, documentation of variation in the final lateral /l/ when preceded by the high front vowel /i/ occurred before documentation of variation in the final later /l/ when preceded by the mid-high front vowel /e/. Moreover, it was again the case than men and women were presented separately.

Variation in /l/ when preceded by high front vowel

Presently, variation in the bilinguals' lateral phoneme /l/ when preceded by the high front vowel /i/ is reported. Here it was investigated whether F1 and F2 in the lateral phoneme /l/ (in this specified position) were within the monolingual norms of German and English, or whether merging occurred between the L1 and L2 of the bilinguals. More precisely, the aim was to investigate within each individual:

- Hypothesis 3a (the F1 of the lateral phoneme /l/ will be the same in the bilinguals' German and English); and
- Hypothesis 3b (the F2 of the lateral phoneme /l/ will be the same in the bilinguals' German and English).

In Figure 4.11 and Figure 4.12, the F1 and F2 of, respectively, the female and male participants are displayed in a scatterplot. The bilinguals are named in these scatterplots, whereas the participants of the monolingual control groups are not (due to lack of space).

Firstly, upon examination of these scatterplots, differences between the German and English control groups, which were discussed in the group analyses of the previous sections, are displayed. The English monolinguals patterned towards the lower right-hand side of the scatterplot (indicating a higher F1 and a lower F2), while the German monolinguals patterned towards the higher left-hand side (indicating a lower F1 and a higher F2). There was no overlapping in the monolingual results for F1 and F2 frequencies, suggestive of distinct realisations, which has consequences for the interpretation of the bilingual data.

Furthermore, in specifically addressing Hypothesis 3a and 3b, it appeared from Figure 4.11 and Figure 4.12 that only two participants (4ExFS and 7ExID) evidenced a clear merging of the /l/ phoneme in German and English. In other words, these participants realised the same final lateral /l/ in their German L1 as they did in their English L2. The question was therefore whether this merged variant was reflective of the German or English norm - or whether it was perhaps intermediate to these monolingual norms. Interestingly, the participants differed in *how* they merged the lateral phoneme /l/ (in relation to the monolingual norms). More specifically, participant 7ExID's (see Figure 4.11) merged variant of the lateral phoneme /l/ was clearly within the *German* monolingual norm, hence towards the higher left-hand side of the scatterplot, reflective of a lower F1 and a higher F2. Although this participant's /l/ phoneme was merged, it did not indicate first language attrition. Instead, she had in fact not acquired the "dark" English phoneme, which was produced in the same way as her German phoneme /l/ (at least in terms of this acoustic analysis). Alternatively, participant 4ExFS's (see Figure 4.12) merged variant was within

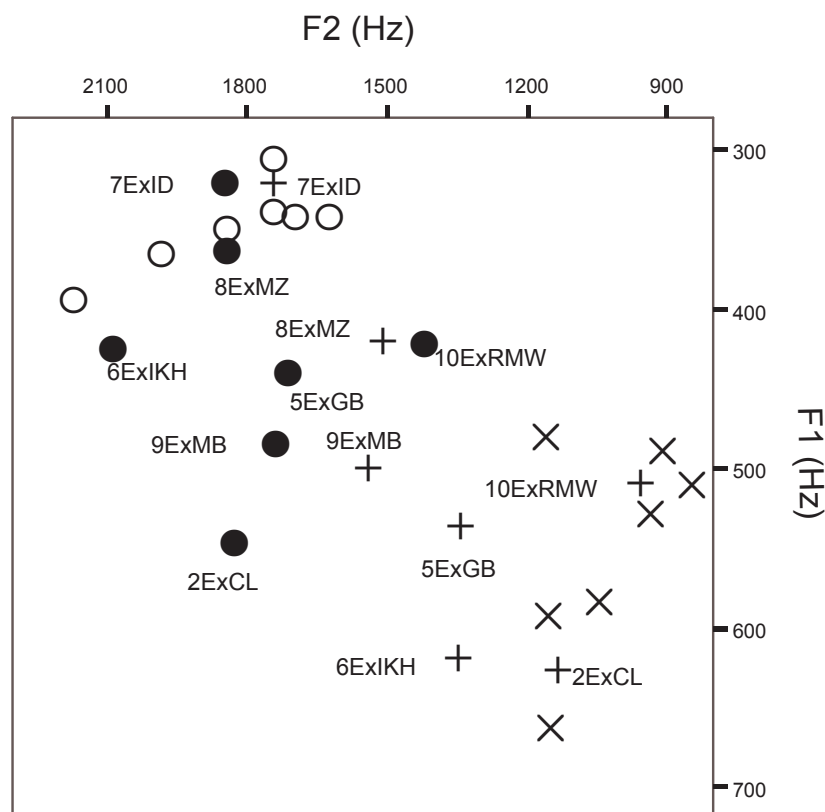


Figure 4.11: Scatterplot of F1 and F2 of females in /l/ after /i/. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

the *English* monolingual norm. He had successfully acquired the “dark” English lateral phoneme /l/ and this was reflected in his German. This was considered to be clear evidence of first language attrition within the lateral phoneme /l/.

For the most part, the other bilinguals did not merge the lateral phoneme /l/ in their German and English. This is to say that their German and English lateral phonemes were different: they are seen on the scatterplots isolated from one another, rather than in close proximity to each other (as was the case for 7ExID and 4ExFS). These other late consecutive bilinguals (1ExBG, 2ExCL, 3ExDZ, 5ExGB, 6ExIKH, 8ExMZ, 9ExMB and 10ExRMW), who realised their /l/ phoneme in German and English as distinct variants, did so in different ways. This is the present focus.

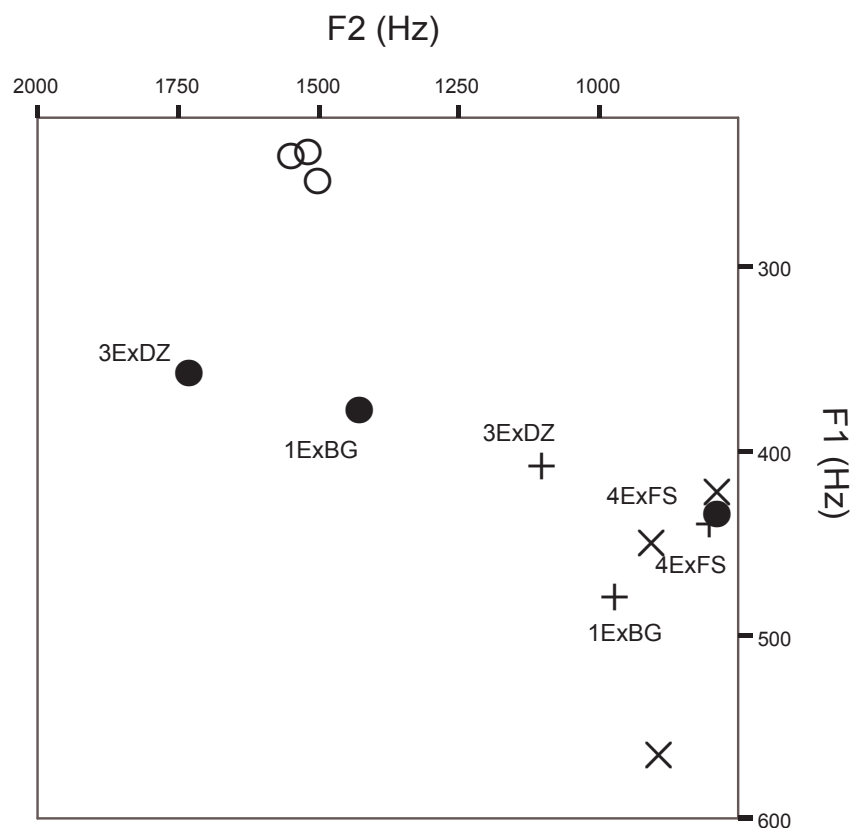


Figure 4.12: Scatterplot of F1 and F2 of males in /l/ after /i/. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

Participants 1ExBG, 2ExCL and 3ExDZ realised their English lateral phoneme /l/ according to the English monolingual norm. Both the F1 and the F2 frequencies of their English /l/ occurred within the range of the English control group (see Figure 4.11 for participant 2ExCL and Figure 4.12 for participants 1ExBG and 3ExDZ). In contrast, their German /l/ was not realised completely within the German monolingual norm. More precisely, the F1 frequency of their German lateral phoneme /l/ was within the English control group's range, whilst the F2 frequency remained high and within the range of the German control group. This suggests that first language attrition was evidenced in the frequency of F1, but not of F2, in the German /l/ of these participants.

Participants 5ExGB and 6ExIKH (see Figure 4.11) performed similarly, although arguably not as clearly. In other words, it was also the case for these participants that the

F2 frequency of the German /l/ of these participants was within the German monolingual norm, remaining high, whilst the frequency of F1 appeared to indicate first language attrition, being rather higher than the German monolingual norm. Their English /l/ was arguably not as clearly within the English monolingual norm as was the case for participants 1ExBG, 2ExCL and 3ExDZ. As evidenced, the F1 in the English /l/ of participants 5ExGB and 6ExIKH was well within the English control group's range. In contrast, the F2 of their English /l/ was on the fringe of the English monolingual norm.

Continuing, participant 9ExMB (see Figure 4.11) also appeared to undergo first language attrition in her German /l/, which was reflected in a higher F1 than in the German monolingual norm (and hence closer to the English monolingual norm). Similar to participants 1ExBG, 2ExCL 3ExDZ, 5ExGB and 6ExIKH, the F1 frequency of her German /l/ evidenced first language attrition, whilst the F2 did not. Instead, the frequency of F2 remained rather high in her German. In her English, the F1 of participant 9ExMB's /l/ was within the range of the English control group. However, the F2 of participant 9ExMB's English /l/ was rather clearly outside of the English monolingual norm (and closer to the monolingual German norm).

Recapping, the previously discussed bilingual participants, who did not display merging, all underwent first language attrition which was evidenced in the frequency of F1, but not in the F2, of their German /l/. In contrast, participant 10ExRMW (see Figure 4.11) underwent first language attrition in her German lateral phoneme /l/ which was evidenced in both the F1 and the F2. For this bilingual participant, the frequency of F1 was higher, *and* the frequency of F2 lower, than the German monolingual norm. In terms of attrition, participant 10ExRMW therefore resembled participant 4ExFS, although the former did not evidence merging in the German and English lateral phonemes. This is to say that her German /l/ was not within the German monolingual norm, but it was also not within the English monolingual norm. Similar to participant 4ExFS, her English /l/ was realised “successfully” well within the range of the English control group.

Finally, participant 8ExMZ (see Figure 4.11) did not evidence first language attrition in her German /l/. Instead, she performed within the range of the German monolingual norm, as did participant 7ExID. In contrast to the latter bilingual migrant, the English /l/ of participant 8ExMZ approached the range of the English control group (although remaining outside of this range).

Summarising the results regarding L1 and L2 variation in the lateral phoneme /l/ when preceded by the high front vowel /i/, it is possible to conclude that merging was less frequent than not merging in the late consecutive bilinguals. Only two participants evidenced a merged phoneme, one within the English monolingual norm (aka L1 attrition accompanied by “successful” L2 acquisition), whilst the other within the German monolingual

norm (aka no L1 attrition, but also lack of “successful” L2 acquisition). Nevertheless, these individual results were intriguing because they were unreported in the group statistics, which had revealed no merging of the German and English lateral phoneme /l/.

Continuing, in those participants who did not merge, both the F1 and the F2 varied between their German /l/ and their English /l/. It appeared that first language attrition was more often evidenced in the F1 of the German /l/, than in the F2 of this phoneme. These results were similar to those of the group analyses. Likewise, it appeared that the F1 of the English /l/ was more likely to occur “successfully” within the English monolingual range than was the F2 of this phoneme.

Variation in /l/ when preceded by mid-high front vowel

In this section, the results for bilingual variation in /l/ when preceded by the mid-high front vowel /e/ are presented. The results are not discussed in detail because they were in fact very similar to those of the previous analysis, investigating /l/ when preceded by the high front vowel /i/.

Figure 4.13 displays the F1 and F2 of the female participants in the lateral phoneme /l/ when preceded by /e/. In Figure 4.14, a similar scatterplot is displayed for the male participants. As was the case in the previous analysis of /l/ after /i/, the bilinguals are named in this scatterplot, whereas the participants of the monolingual control groups are not.

In general, the same overall tendencies are evidenced in these scatterplots. This is to say that the monolingual control groups clustered together and that these clusters did not overlap with each other: the German monolinguals had a lower F1 and a higher F2 than did the English monolinguals. Moreover, only participants 4ExFS and 7ExID displayed merging, the former within the range of the English control group and the latter within the range of the German control group. Hence although merging was not revealed in the group analyses, the individual comparisons did indicate that in these participants the lateral phoneme /l/ was the same in both their L1 and L2.

It was also the case that in the remaining participants, first language attrition was more often displayed in the form of a higher F1 frequency than in a lower F2 frequency. These results substantiated those pertaining to L1 and L2 variation in the lateral phoneme /l/ after /i/ in that first language attrition was again more likely to be displayed in the frequency of F1 than in the frequency of F2 in the late consecutive bilingual migrants.

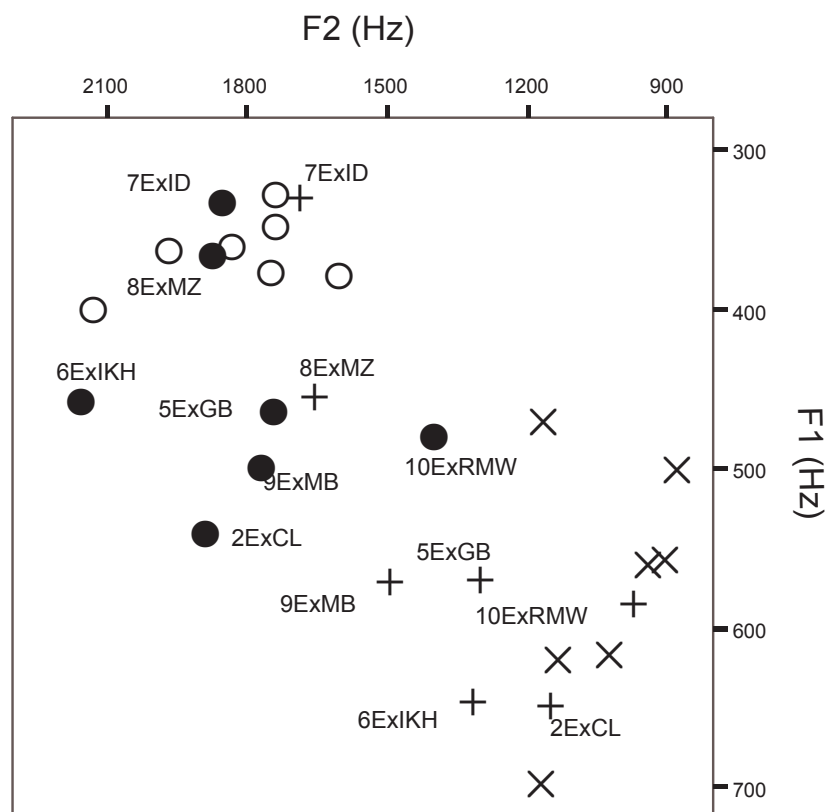


Figure 4.13: Scatterplot of F1 and F2 of females in /l/ after /e/. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

4.3.4 Intrapersonal variation

The focus of this section is on intrapersonal variation in first language attrition in the lateral phoneme /l/. This investigation related closely to Section 4.3.3; but, more specifically, the question here was whether first language attrition was more clearly evidenced in either the frequency of F1 or the frequency of F2 in each late consecutive bilingual migrant. In other words, the present section documents first language attrition from a different perspective than was the case for Section 4.3.3.

The results of this analysis, which are displayed in figures 4.11, 4.12, 4.13 and 4.14, indicated that participants 4ExFS and 10ExRMW evidenced first language attrition in both the frequency of F1 and F2 in the German /l/. In contrast, participants 1ExBG, 2ExCL, 3ExDZ, 5ExGB, 6ExIKH, and 9ExMB revealed first language attrition in the

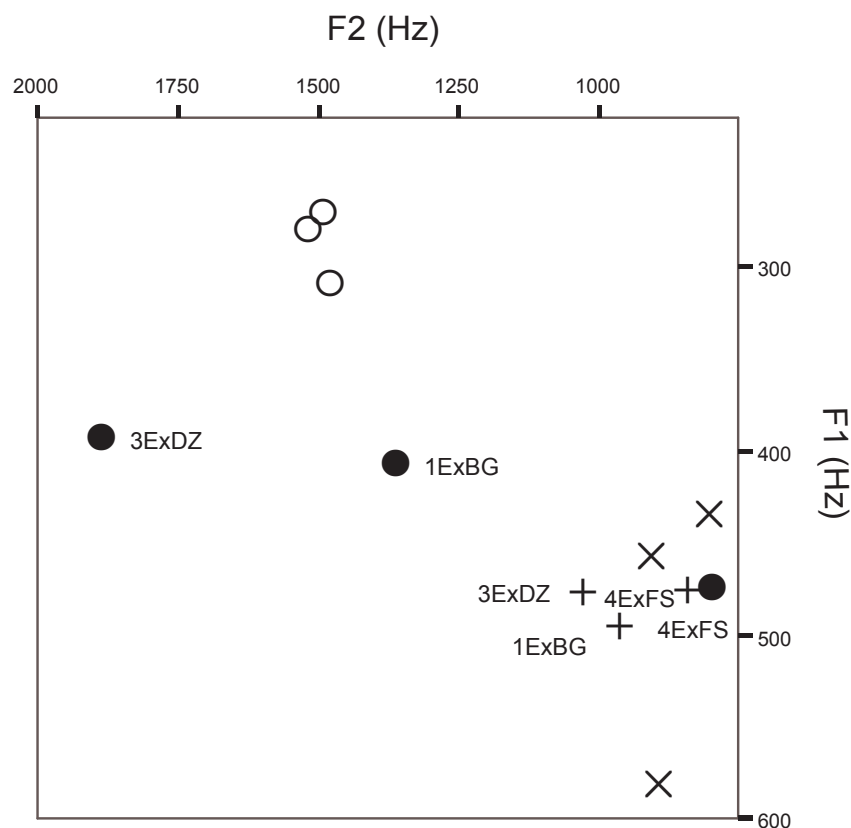


Figure 4.14: Scatterplot of F1 and F2 of males in /l/ after /e/. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

frequency of F1, but not in F2, which remained conducive to the German monolingual norm. Finally, participants 7ExID and 8ExMZ revealed first language attrition in neither the F1 nor the F2 frequency of the German /l/.

4.3.5 Interpersonal variation and predictor variables

Given that the late consecutive bilinguals displayed interpersonal variation regarding the production of the lateral phoneme /l/ in word final position, predictor variables were examined to see whether these may have influenced the individual results of the participants. As already mentioned, the predictor variables included in this analysis were age of arrival, length of residence, amount of contact with the German language and type of contact with

German.

Only women were investigated in this investigation because the male group was considered to be too small, with only three participants, to investigate correlation effects. Moreover, it was considered to be redundant to perform Pearson's correlation tests on each previously discussed dependent variable (hence the F1 and the F2 in both the lateral /l/ when preceded by /i/ and /e/). Instead, because first language attrition in the domain of phonetics had been clearly evidenced in the F1 frequency of /l/ when it was preceded by the high vowel /i/, it was this variable which was more closely examined here in relation to the selected predictor variables. The mean of each bilingual female (in German) went into these Pearson's correlation tests.

Consistent with the previous research discussed in Chapter 1 (see specifically Section 1.3.3), it was predicted that an earlier age of arrival would be associated with a higher F1 frequency in this phonetic context. Moreover, it was predicted that a longer length of residence would correlate with a higher F1 frequency and that higher values for amount and type of contact would similarly be associated with a rise in the frequency of F1 in the lateral phoneme /l/. These results are reported with one-tailed significance, and in accordance with the Bonferroni correction, at the α – level of 0.013 (given that four tests were performed).

There were no significant relationships between any of the predictor variables and F1 frequency: for age of arrival, $r = -.27$, $p = .28$ (one-tailed); for amount of contact, $r = -.10$, $p = .42$ (one-tailed); and for type of contact, $r = -.20$, $p = .39$ (one-tailed). However, length of residence approached significance in this analysis, $r = -.69$, $p = 0.04$ (one-tailed). Surprisingly, if the coefficient was considered, it appeared that there may have been a negative correlation between length of residence and F1 frequency (see Figure 4.15). This suggests that, although the results were not significant, the longer bilingual migrant females resided in Anglophone Canada, the *lower* their F1 was, or the more German-like. In other words, those bilingual women who had lived longer in Canada underwent the less first language attrition the phonetic realisation of their lateral phoneme /l/.

In sum, length of residence was the only predictor variable which may have been correlated with first language attrition in /l/ of the late consecutive bilingual migrants (although due to the Bonferroni correction the result was not significant). Surprisingly, the potential relationship was opposite to the one expected. It was in fact a longer length of residence which may have been associated with *less* first language attrition in the domain of phonetics.

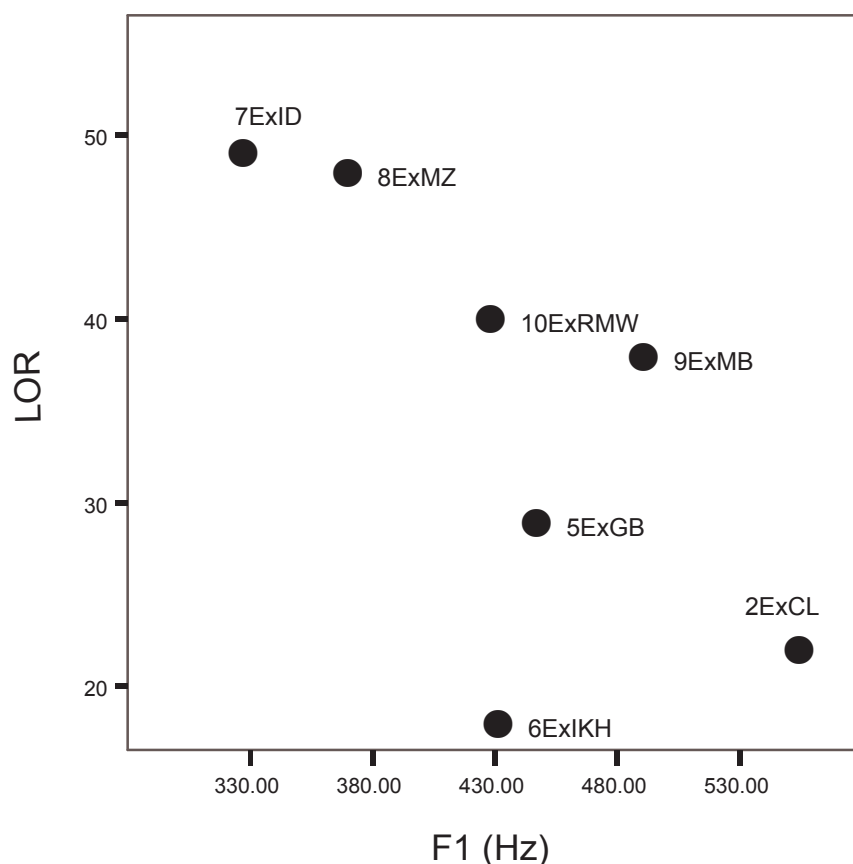


Figure 4.15: Scatterplot of LOR against F1 in /l/ after /i/ in the German of the female bilingual migrants.

4.4 Discussion of lateral analysis

To commence the discussion of the lateral analysis, the findings from the hypotheses testing are initially examined. The results from the first set of hypotheses were confirmed. More specifically, the frequency of F1 in the lateral phoneme /l/ of the German control group was significantly lower, and the frequency of F2 significantly higher, than of the English control group. These findings substantiated numerous studies which have investigated the lateral phoneme /l/ in German and English (see Section 4.1). In the present study, the German /l/ was “light” or “clear” ([l]), whilst the English /l/ was “dark” ([ɫ]).

Leaning on Recasens, who states that “Dark [l] has been set in contrast with clear [l] based on well defined articulatory and acoustic properties, namely, the formation of a post-dorsal velar or pharyngeal constriction and active pre-dorsum lowering causing F2

to lower and F1 to raise” (2004 : p. 594), it is possible to infer that in the present study, the back of the tongue was rather flat during the production of the lateral phoneme /l/ on the part of the German control group, whereas the back of the tongue was elevated on the part of the English control group. Moreover, pre-dorsum lowering, or the lowering of the front of the tongue (associated with a wider jaw angle), occurred in the English control group, whilst not in the German control group.

Moreover, it appeared that German and English monolinguals displayed distinct phonetic categories in their realisation of the lateral phoneme /l/. This is to say that overlapping of the frequency of F1 in German and English, and in the frequency of F2 in German and English, was negligible.

Moving on, the findings from the second set of hypotheses suggested that first language attrition in the lateral phoneme /l/ was more clearly evidenced in the frequency of F1 than in the frequency of F2. In the group analyses, all tests revealed first language attrition in the frequency of F1 for female and male bilinguals. In contrast, the frequency of F2 between the female bilinguals and their respective control group did not significantly differ. Regarding the males, the frequency of F2 significantly differed in the lateral phoneme /l/ as measured after /i/, but not as measured after /e/. These group analyses suggested a greater amount of stability in the frequency of F2 than in that of F1.

In the analyses of individual participants, the group tests regarding the second set of hypotheses were also confirmed. More specifically, F1 frequency of the lateral phoneme /l/ again appeared to be less stable than the F2 frequency. This confirmed that attritional effects were more often evidenced in the F1 frequency of the lateral phoneme /l/ than in the F2 frequency. Indeed, only two late consecutive bilingual migrants evidenced first language attrition in the F2 frequency of the German /l/, whereas eight (the same two plus six more) did so in the frequency of F1.

These findings may suggest that place of constriction was less prone to first language attrition than openness, or pre-dorsum lowering. If the former is associated with F2 frequency, and the latter with F1 frequency, it appears that lack of pharyngeal constriction was maintained more often than not in the late consecutive bilingual migrants. The findings also revealed that F1 frequency was not only more likely to undergo first language attrition, but that it was more likely to be acquired by the late consecutive bilingual migrants in their L2. This raises the why question. If F2 frequency was determined by place of tongue constriction, and F1 frequency was determined by openness, or pre-dorsum lowering, it may be that fluctuations in F1 frequency were more perceivable than those in F2 frequency on the part of bilingual migrants given that, visually, it is possible to see how open the mouth is, but not where the tongue constriction occurs within the mouth. This added visual information may contribute to destabilising the frequency of F1 in the

bilinguals' L1 (and acquiring it in their L2) but not of F2 in the /l/ phoneme. Such an interpretation is of course inconclusive, but it emphasises the bimodal quality of speech production and perception. Other explanations may point towards differences in particularly the auditory perception between F1 and F2 frequencies, or towards overall phonetic settings, i.e. how the lateral phoneme /l/ relates to general pronunciation tendencies within each language. Put simply, perception studies are necessary to conclude the interpretations of these findings.

Whatever the explanation as to why the F1 frequency was more likely to evidence first language attrition than the F2 frequency, the fact that the lateral phoneme /l/ was investigated according to two dimensions in the present study, has intriguing consequences for the Speech Learning Model (1995, 1999, Flege et al., 2003). As already explained, according to the SLM, it is those sounds which are most similar which are *most difficult* to learn for L2 language learners (Flege, 1995; Flege et al., 2003). However, when more than one dimension of a particular sound is examined, the findings for these dimensions may diverge. Based on the present results, it appears that a sound (whether similar or dissimilar) is not simply a sound, but rather a combination of multiple dimensions which differ in the extent to which they are both acquired in L2 acquisition as well as lost in L1 attrition. In many previous investigations regarding the SLM, only one dimension of a sound has been investigated (for example only voice onset time, or only frequency of F2, see Section 1.2.3), but the present study indicates that when more than one dimension of a sound is investigated, the situation becomes more complex.

Continuing, in terms of the third set of hypotheses, the lateral analysis revealed that merging of the distinct German and English lateral phonemes was the exception rather than the rule. Instead, late consecutive bilinguals appeared to “assimilate” the F1 frequency of their lateral phonemes, meaning that they tended to approach one another (but this was not the case for all bilinguals, nor was it the case that the F1 frequencies consistently “met in the middle” of the monolingual norms). Nevertheless, distinct F1 frequencies were for the most part maintained, or achieved, whichever way it is looked at, in the L1 and the L2 of the bilinguals. The F2 frequency of the bilinguals for the most part remained within the norm of the German monolinguals, although it also may have been less likely to be acquired in their English L2.

Moving on, it was suggested that there was a negative correlation between length of residence and F1 frequency in the lateral phoneme /l/. Although these results were not significant, it appeared that the longer bilingual migrant females resided in Anglophone Canada, the lower their F1 frequency was, or the more German-like. In other words, those bilingual females who had lived the longest in Canada surprisingly seemed to undergo the least first language attrition. It may be that the same tendency was observed in the present

study as in the research by Prescher (2007 : p. 201), who found that “the longer the duration of immigration, the stronger the attempt to return to the original identity and language” (see page 41 in the present thesis). It stands to reason that the bilinguals of the present study, after a longer length of residence in Canada, potentially focused on achieving a more German-like pronunciation in their L1. What this means in terms of the performance versus competence debate is inconclusive. It could suggest that the migrants had, in actuality, only superficially “lost” their native-like pronunciation of the lateral phoneme /l/.

Chapter 5

L1 attrition of prenuclear tonal alignment in German

5.1 Prenuclear tonal alignment in German and English

Research suggests that German and English differ at not only the segmental level, as described in the previous chapter, but also in their prosody. In this chapter, a particular aspect of intonation is examined, that of prenuclear tonal alignment. The aim is therefore to investigate first language attrition on the basis of differences in the realisation of prenuclear tonal alignment in German and English.

Generally speaking, tonal alignment is defined according to the time dimension of intonation (Arvaniti et al., 1998; Ladd, 1996; Mennen, 2007). The phenomenon of the F0 (fundamental frequency) contour aligning with specified targets in the segmental string has been attributed to Bruce (1977) and his study on Swedish word accent (Arvaniti et al., 1998; Ladd et al., 1999; Atterer and Ladd, 2004). Bruce observed that in Swedish accented syllables were in all cases accompanied by a fall from a local F0 peak to a valley. However, he distinguished between two different F0 contours on the basis of *where* the peak occurred in relation to the neighbouring segmental items. Bruce summarised for the Swedish accentual distinction, “reaching a certain pitch level at a particular point in time is the important thing, not the movement (rise or fall) itself” (1977 : p. 132). Emanating from Bruce’s original observation, tonal alignment has been defined by, amongst others, Atterer and Ladd as the “temporal coordination of fundamental frequency (F0) with phonetic segments” (2004 : p. 177).

As is the case with the segmental realisation of the lateral phoneme /l/, German and English share similarities in their realisation of tonal alignment. Ladd (1996) noted that German and English are similar in *nuclear* tonal alignment. The nuclear accent refers to

the main pitch accent of an intonational phrase, or the one with the most prominence, and it is usually thought to be the last pitch accent in an intonational phrase (Mennen, 1999 : p. 62). More specifically, Ladd (1996) noted that in both German and English the peak and the fall of the rise occur relatively late in *nuclear* tonal alignment.

Although German and English nuclear tonal alignment realisations may share similarities, recent research suggests that tonal alignment in *prenuclear* syllables differs in these languages (Atterer and Ladd, 2004). The prenuclear accent is the pitch accent which occurs non-finally in an intonational phrase (Mennen, 1999 : p. 62). For the purpose of the present study, the results by Attterer and Ladd (2004) are of particular interest. In brief, their study found that in prenuclear rising accents, the alignment of the rise occurs *earlier* in English than it does in German (Atterer and Ladd, 2004). Accordingly, in this part of the production analysis into first language attrition, the focus was on whether prenuclear tonal alignment in the native German speech of the migrants lost its German quality, potentially aligning earlier, than in the German control group. The present study is modelled upon the original study by Attterer and Ladd (2004), which is examined in detail here.

The results of the investigation by Attterer and Ladd (2004) are threefold. As just mentioned, crucial to the study at hand, they report that the start of the prenuclear rise (which they annotate in accordance with the autosegmental-metrical framework as ‘L’) in the German L1 speakers was “strikingly divergent” from previous English results (2004 : p. 185).¹ “The German speakers align the start of the rise well within the initial consonant of the stressed syllable or even early in the stressed vowel” whereas “L is aligned at or slightly before the beginning of the onset consonant of the stressed syllable” by English native speakers (2004 : p. 185). Moreover, German speakers aligned the peak of the rise within the following unstressed vowel, which is described as being “rather later than the findings of Ladd et al. (1999) for British English” (2004 : p. 185). The finding that both the start and the end of the rise in the prenuclear syllable was aligned markedly later in German than in English warrants the present investigation into potential first language attrition in the native speech of the German migrants in Canada.

More recent studies have in part confirmed the findings from Attterer and Ladd (2004) that German aligns prenuclear rises later than English. In particular, the results of Mücke et al. (2006) similarly indicate that for their German native speakers (two female students in their mid-twenties who spent their first 20 years in the low Franconian speech area near to Düsseldorf) “H was closely phased with the vowel production of V2 [the vowel

¹The term ‘autosegmental-metrical’ was coined by Ladd (1996) and refers to the approach to intonation which treats high (H) and low (L) tones as the fundamental units used to describe intonation. Very generally, this approach differs with other approaches which treat pitch *movements* as the basic descriptive units of intonation (Ladd, 1996).

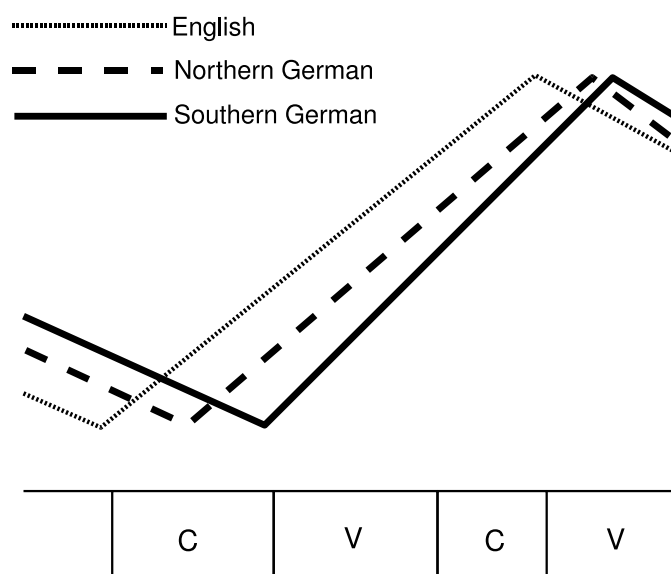


Figure 5.1: Schematic representation of tonal alignment in German and English (reproduced from Atterer and Ladd, 2004 : p. 187). As noted, the segmental durations are idealized.

following the prenuclear syllable] in prenuclear rises in German” (p. 299). Again, this points towards a later alignment than in English.

Another finding reported by Atterer and Ladd (2004) was that of dialectal variation in prenuclear rising accents in German. Their study did not enter into a detailed description of intonation in regional variants, but rather broadly categorised into the two main groups of Northern and Southern German. They note: “The Southerners were all from Bavaria. The Northerners were all from the north-west of Germany (Schleswig-Holstein, Hamburg, Niedersachsen and the north of Nordrhein-Westfalen)” (pp. 182 - 183). In line with previous descriptions of German intonation (Gibbon, 1998), Atterer and Ladd report that the beginning of the prenuclear accentual rise occurs significantly earlier in speakers from Northern Germany than in those from Southern Germany. Crucial to the overall purpose of the present investigation, *both* Northern and Southern varieties aligned their prenuclear rising accents *later* than English speakers (Ladd et al., 1999; Atterer and Ladd, 2004). These results, displayed in Figure 5.1, form the core of the present production analysis into first language attrition of prosody in German native speakers. Given that the present study investigates Canadian English, rather than British English (as was the case in Atterer and Ladd’s study), English regional variation is also considered to be of relevance, as will be discussed briefly.

Another aspect of their study examined whether German L1 speakers carried over their relatively late prenuclear tonal alignment into their English L2 speech. As noted by

Atterer and Ladd (2004), the participants were all living in Germany, where the recordings took place. “All studied English in school and all use it to one extent or another in their professional life” (p. 189), but none are described as having had long-term exposure to the English language such as was the case for the German migrants in the study at hand. Attterer and Ladd report that “on identical English speech material, the German speakers align the accentual rise later than the native English speakers. This conclusion seems statistically robust for the alignment of the L and plausible for the alignment of the H” (p. 191). If this finding is related to the present study, the question arises whether a similar influence might be detected in the L2 speech of the migrants, or, given their long-term exposure to English, whether first language attrition may be evident in their native German.

As previously mentioned, it should be emphasised that Attterer and Ladd’s (2004) comparative analysis involved British English, rather than Canadian English, which was the L2 of the German migrants here. More specifically, their speakers spoke Standard Southern British English. Four female and four male speakers who were undergraduates at Edinburgh University in their early 20s were recorded (Ladd et al., 1999). This meant that if Canadian English tonal alignment did not pattern in the same way as British English, an effect may not have occurred in the present study. Nevertheless, it was suspected that Canadian English and British English pattern similarly with regard to prenuclear tonal alignment. The reasoning for this line of thought was partly based on Attterer and Ladd’s (2004) own interpretation of their results. In their study an alternative explanation of the late prenuclear rise on the part of the German L1 speakers in their L2 of English could have been that the speakers were realising a more North American English (aka Canadian English as well) than a British English (if in American English prenuclear rises are aligned later, similar to German). Instead, the assumption by Attterer and Ladd (2004) was that the German native speakers’ alignment reflected the (relatively later) tonal alignment patterning of their L1. An alternative interpretation, that the German native speakers may have learned a non-British variety (which may have been more similar to German), was not given by Attterer and Ladd (2004), hence the indirect assumption made on their part that it is in general *English* which aligns prenuclear rises earlier than German. All the same, the second control group of Canadian monolinguals, which were brought into the study at hand, functioned as verification of this. In other words, an early alignment of prenuclear rises in the Canadian English control group was a prerequisite for a successful investigation into first language attrition in the late consecutive bilinguals.

A final point which is of importance in the interpretation of Attterer and Ladd’s (2004) study is that of rate of speech, or more specifically the durational effects of the segment and syllable on tonal alignment. Attterer and Ladd approach this issue in their Appendix

A: “One obvious problem is the speaking rate. To describe a given F0 target F as occurring x milliseconds before segmental landmark S may mean something different depending on whether the speakers average segment duration is 50 or 80 ms” (p. 194). Particularly if speed of speech slows down, as it may do in L2 speech (Wiese, 1984; Guion et al., 2000b), absolute calculations may therefore not be adequate. Moreover, some studies indicate that speech decelerates as one ages (Linville, 1996). Although no study has of yet investigated age and tonal alignment, *if* age plays a role in determining tonal alignment (as speech slows down), the language specific effects observed by Atterer and Ladd (2004) may similarly not have been apparent in the present study. For example, if rising accents are “anchored” to the segmental string, one could expect later absolute measures, particularly for the end of the rise, in the older participants, as well as in the participants with less proficient, or slower, L2 (or L1) speech. These later absolute measures may in contrast not be present when relative tonal alignment is considered in relation to the overall length of a particular sequence in the segmental string. As already mentioned in Chapter 3, it is partly for this reason that the control groups of German and English native speakers were within the same age range as the experimental subjects.

Moreover, as will be discussed, it was due to potential differences in speed of speech across participants that both absolute and relative tonal alignment measurements were calculated in the present study. As will be precisely explained in Section 5.2.3, the absolute measures were termed MIN_{abC0} , MIN_{abV0} and MAX_{abC1} . The former terms refer to the start of the prenuclear rise and the latter term refers to the end of the rise. The relative measures were termed MIN_{rel} and MAX_{rel} and again, these respectively specify the start and the end of the prenuclear rise - in relation to the duration of the prenuclear syllable.

Summarising, the present analysis into first language attrition in the German of late consecutive bilingual migrants premised on the findings by Atterer and Ladd (2004) which indicated that in prenuclear rising accents, the rise aligns later in German than it does in English. In order to investigate this part of the production analysis, both absolute and relative measurements were calculated. The foremost objective was to determine whether the German of the bilingual migrants patterns differently from that of the German control group. Further attention was on whether potential first language attrition in the German migrants to Canada was associated with the second language acquisition of this same prosodic variable.

5.1.1 Hypotheses

Based on the information described above, as well as that of Chapter 3, the following hypotheses were tested.

1. First set - control groups

- (a) The absolute tonal alignment of the prenuclear rise will occur significantly later in the German control group than in the English control group.
- (b) The relative tonal alignment of the prenuclear rise will occur significantly later in the German control group than in the English control group.

2. Second set - first language attrition

- (a) The absolute tonal alignment of the prenuclear rise will occur significantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group.
- (b) The relative tonal alignment of the prenuclear rise will occur significantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group.

3. Third set - merging effects

- (a) The absolute tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English.
- (b) The relative tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English.

5.2 How was prenuclear tonal alignment measured?

This section describes the presentation of the tonal alignment sentences, as well as the annotation and measurement procedures. The measurement of the tonal alignment sentences allowed for a descriptive and statistical comparison in the experimental and control groups in order to test the hypotheses listed above.

5.2.1 Presentation

As already discussed, the sentences which were used to measure tonal alignment were presented to the participants after the short break which followed the lateral task. The tonal alignment task was therefore the second to last task, preceding the pitch analysis task. As mentioned in the previous chapter, in line with Grosjean's description of language modes (2001), the German tonal alignment task was presented to the participants in the German language half, and the English tonal alignment task was presented in the

English half. In German, the total duration of the tonal alignment task was just over six minutes, whereas in English it took just over 8 minutes. Given that in both languages the tonal alignment task was much shorter than the lateral task, an intermittent break was not thought to be necessary.

In both languages, the participants were given 12 seconds to produce each token sentence. Participants were asked to speak naturally in a way in which they felt comfortable. The slides appeared automatically on the monitor and in contrast to the lateral task, participants were instructed to read each sentence to themselves before saying out loud. This was done because some of the sentences were considered to be particularly novel and it was thought that there may have been slip-ups if the sentences were elicited as soon as they appeared on the monitor. The participants were asked to try and repeat the sentence if they felt that they had mispronounced their first attempt. They were told that if they thought that there was not enough time to repeat a sentence, it did not matter and that in such a case they should just continue on with the next sentence as it appeared. The decision to repeat a sentence was therefore left up to the participant, and it was thought that this created a more relaxed atmosphere. In the case that more than one token syllable was elicited for a particular sentence, the most fluently produced sentence was chosen for the analysis. If more than one sentence was produced fluently, the first attempt was chosen for the analysis.

Both the German and the English tonal alignment tasks commenced with a practice session of three sentences. In the German part, 11 target sentences interspersed with 16 fillers followed the practice sentences (see Appendix C.1). In the English part, 14 target sentences interspersed with 20 fillers followed the practice sentences (see Appendix C.2). The filler sentences focused on topics which were considered to be at least somewhat culturally specific. This was again done to enhance the respective language mode (Grosjean, 2001). The sentences containing prenuclear rising accents were for the most part the same as those used in the study by Atterer and Ladd (2004), as will be discussed, but the filler sentences were created specifically for this study.

It is worth noting that two sentences from the original German section in the study by Atterer and Ladd (2004) were not included. This was because in the present study, the sentences were displayed through an on-screen slide show (Microsoft PowerPoint™) and the two sentences excluded were too long to have had an adequate reading size on the computer screen.

The German sentences used in the tonal alignment analysis and their English translations are displayed in Table 5.1; the English tonal alignment sentences are displayed in Table 5.2. Given that the target sentences for the present study were for the most part the same as those used in the study by Atterer and Ladd (2004), the sentences also met the

5.2. How was prenuclear tonal alignment measured?

<i>Die Verlängerung der Ausleihfrist ist leider nicht möglich.</i>
Unfortunately it's not possible to extend the loan's deadline.
<i>Die Erennung Meiers zum Minister wurde nicht von allen Parteimitgliedern begrüßt.</i>
Meier's appointment to Minister wasn't welcomed by all of the party members.
<i>In Ermangelung eines Lehrers übernahm ein Student den Unterricht.</i>
A student took over the lesson in the absence of a teacher.
<i>Die Lungentätigkeit des Patienten mußte künstlich aufrecht erhalten werden.</i>
The patient's lung activity had to be artificially maintained.
<i>Seine mangelhaften Leistungen erlaubten es ihm nicht vorzuriücken.</i>
His less than satisfactory results didn't allow him to advance.
<i>Die nonnenhafte Kleidung steht ihr überhaupt nicht.</i>
The nunlike clothing doesn't suit her at all.
<i>Auf Verlangen von Herrn Müller haben wir unser Sortiment erweitert.</i>
We expanded our assortment due to Mr. Muller's requirements.
<i>Die mollige Dame bezauberte durch ihr Lächeln.</i>
The chubby lady captivated with her smile.
<i>Die Minnesänger von Nürnberg waren sehr berühmt.</i>
The minstrels from Nurnberg were very famous.
<i>Bei Längengrad Null wird die Universalzeit bestimmt.</i>
Universal time is decreed at zero degrees longitude.

Table 5.1: The German tonal alignment sentences with their English translations. The prenuclear syllable is bold.

same criteria as those in the original study. This meant that in order to prompt a prenuclear rising accent, the test word was either an adjective followed by a noun, or a noun followed by a genitive construction. This helped to ensure that a prenuclear rising accent was put on the test syllable, which was followed by a nuclear accent on the following noun. Moreover, the prenuclear syllable was flagged by one or two unstressed syllables. This decreased the likelihood of tonal crowding (Arvaniti et al., 2006). The test syllable also always contained a phonologically short vowel, in order to decrease the probability of differences in vowel length affecting tonal alignment patterns (Mennen, 2004). Finally, the consonants which flagged the vowel in the test syllable were always sonorants (either nasals or laterals) which ensured a smooth F0 contour (Atterer and Ladd, 2004 : p. 182).

There was a nominal fee for his services.
There is a phenomenal interest in the products.
She got a unanimous vote for the proposal.
They got an anonymous call from a witness.
He made a lemony sorbet for dessert that evening.
She's a minister's wife in the Home Counties.
There were monogrammed sheets in the hotel rooms.
There is a minuscule chance of surviving a plane crash.
I need a monosyllabic word for my crossword puzzle.
They sentenced the militant splinter group to five years.
You need a mineral and vitamin supplement to get well.
They charge a minimum rate for the use of their phone lines.
He took a mineral enriched supplement every morning.
They showed a minimal interest in what he had to say.

Table 5.2: The English tonal alignment sentences. The prenuclear syllable is bold.

5.2.2 Annotation

As was the case in the original study, within each test syllable, the following landmarks were identified (Atterer and Ladd, 2004 : pp. 183 - 184). The segmental landmarks were as follows: C0 marked the onset of the initial consonant of the test syllable; V0 marked the onset of the vowel of the test syllable; C1 marked either the onset of the final consonant of the test syllable (for example in “*Verlangen*”), or, in line with the Maximal Onset Principle, the onset of the first consonant in the following syllable (for example in “*nonnenhafte*”); and V1 marked the end of the final consonant of the test syllable, or the onset of the vowel of the following syllable. The markers of the pitch accent were MIN and MAX. MIN was inserted at the beginning of the F0 rise in the prenuclear rising syllable and MAX was marked at the end of the F0 rise.

All markers were inserted at the lowest point of the cycle in the waveform. Although small deviations of a single cycle would probably not have impacted the overall results of the study, this was done to ensure consistency. Examples of where the landmarks were inserted can be seen in Figure 5.2 and in Figure 5.3.

The F0 minima and maxima were generally easy to locate, but in some cases, it was difficult to insert either the MIN or the MAX at a given point because it was unclear where the F0 rise began (MIN) and ended (MAX). As already mentioned, this was largely due to changes in slope. When there was an obvious change in slope, no problem arose, but if there was only a slight change in slope, the insertion of MIN and MAX became problematic. In these cases, the most prominent change of slope was estimated by eye and either MIN or MAX was inserted as appropriate, as was done in the study by Attterer

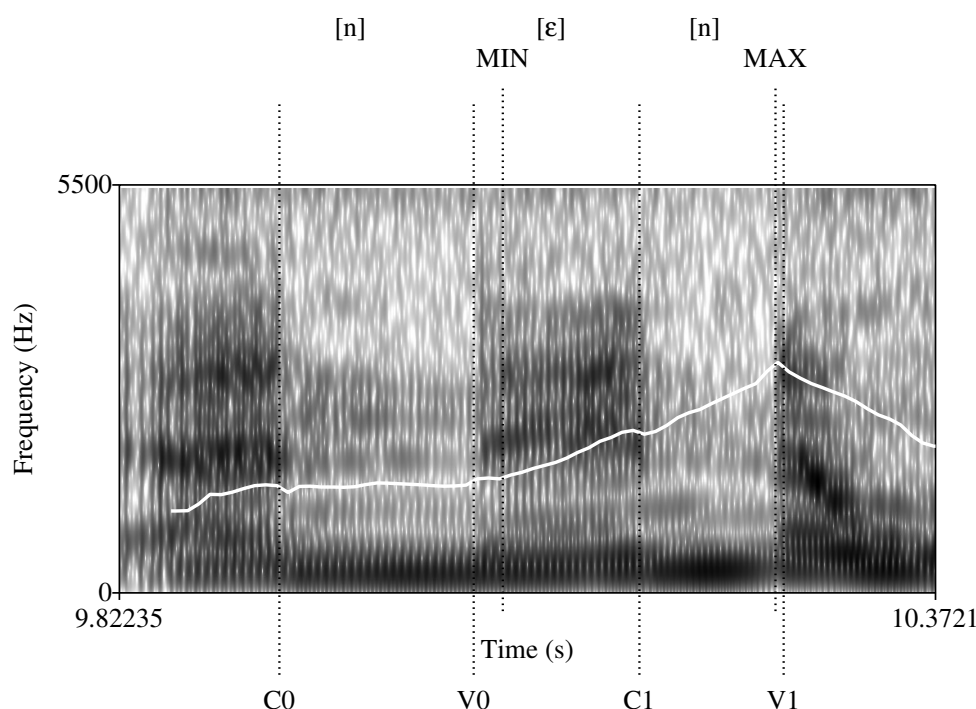


Figure 5.2: A portion of the word ‘Ernennung’ as spoken by a female German control participant. In this example, MIN occurs quite late (in the vowel), and MAX occurs as expected around the end of the second consonant. Pitch contour is superimposed, meaning that the frequency scale of the y-axis is not representative of the actual fundamental frequency.

and Ladd (2004 : p. 184) as well as in other studies (Mücke et al., 2006 : p. 297).

Finally, it should be mentioned that the test sentence ‘*Ein nennenswerter Unterschied war nicht auszumachen*’ was completely discarded due to the fact that two nasals bordered one another at the onset of the test syllable, making the insertion of C0 impossible.

5.2.3 Measuring tonal alignment

The specific command used to extract pitch in Praat was Sound : To Pitch (ac). As recommended in the Praat guidelines, the standard settings for pitch extraction were as follows:

- Time step : 0.0. The measurement interval (frame duration), in seconds.
- Very accurate : off. A Hanning window with a physical length of 3 / (pitch floor) was used.
- Pitch range : dependent upon whether a man or a woman was analysed. If a man was examined, pitch range was set to 60 - 300 Hz. If a woman was examined, pitch

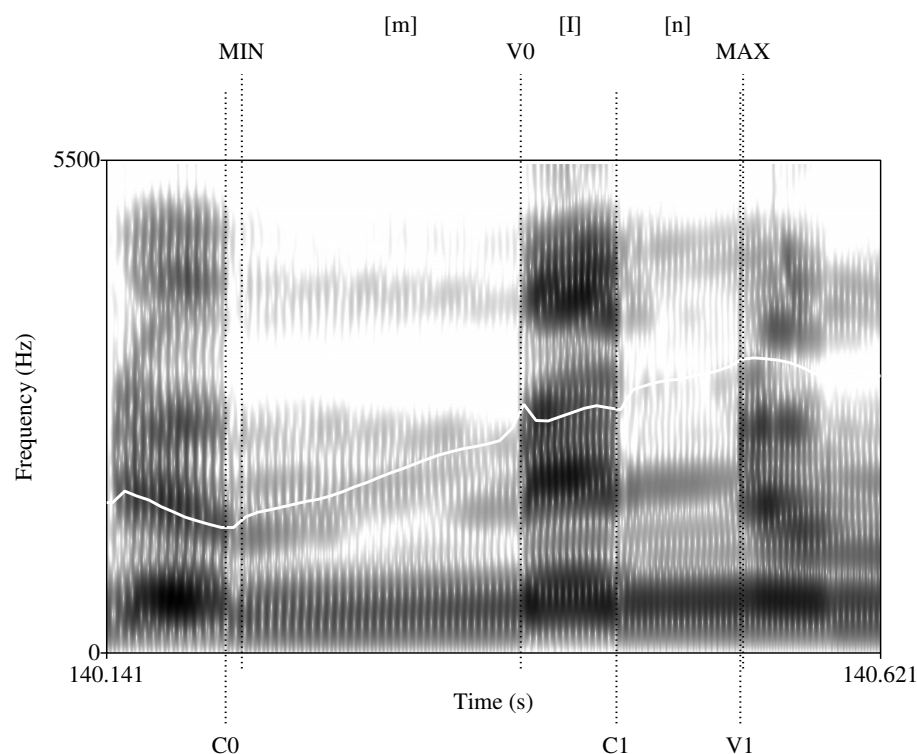


Figure 5.3: A portion of the word ‘minimal’ as spoken by a female English control participant. In this example, MIN occurs as expected close to the beginning of the first nasal. MAX occurs just after the end of the second nasal. Changes in microintonation are particularly noticeable at C0, V0 and C1. Pitch contour is superimposed (please see Figure 5.2).

range was set to 90 - 400 Hz. In some cases, particularly in those of the younger women, pitch range was increased to 500 Hz. This ensured that all frequencies were included in the extraction process.

- View range : was generally the same as pitch range. When a narrow pitch range was evident view range was narrowed for the specific token in order to observe the relative pitch contour movement more easily. This did not affect the automatic extraction of the pitch contour, but rather facilitated the process of locating MIN and MAX for annotation.

A problem which arose was that of “minor F0 discontinuities” or “blips” (Atterer and Ladd, 2004 : p. 184). Such microintonation variation in transitions from nasals to vowels (or *vice versa*) resulted in the present study in either small dips or points in the intonation contour, but did not bias the analysis of overall sentence intonation. The changes in microintonation are particularly evident in Figure 5.3. Here the pitch transition from the vowel to the sonorant is evident in a dip, whereas the pitch transition from the sonorant to the vowel is evident as a peak. As was the case in the study by Attner and Ladd, F0

blips at the closure or release of nasals were ignored in determining MIN and MAX. This is to say that MIN and MAX were inserted as though the changes in microintonation had not occurred, e.g. the pitch contour of the sentence continued in a linear manner from the start of the ‘blip’ to its end.

Similar to in the original study, not every test item could be measured. This was due to a number of reasons. Firstly, when the test syllable was not realised as a prenuclear syllable, it was discarded. This occurred in a limited number of cases, but was nevertheless a reason to discard a token. Secondly, if the overall intonation was too monotonous, it was very difficult to locate F0 minima and maxima because little variation in the intonation pattern occurred. Some tokens were discarded because of this, especially from participant 7ExID. Finally, tokens were also discarded as a result of changes in voice quality. In some participants, creaky voice occurred in the test syllable, creating a drastic fall in the F0 contour which caused the token to be discarded. On average, in the German of the experimental group, 9.0 tokens per participant were included in the analysis, and in the German of the control group, an average of 9.1 tokens per participant were included. In comparison, in the original study, an average of 11.6 utterances per speaker were used for the analysis (Atterer and Ladd, 2004 : p. 184). Given that three sentences from the original study were not included in the present investigation, the rate of inclusion in the present analysis was in fact quite similar to that of the original analysis.

As already specified, tonal alignment was measured in both absolute and relative terms. The reason for measuring tonal alignment in absolute terms was that this is the manner in which the study by Attner and Ladd (2004) was conducted. Calculating the absolute difference in milliseconds (ms) between the specified segmental landmarks and MIN and MAX allowed for a comparison of the participants in the present study with those in the study by Attner and Ladd (2004). In other words, the question of whether the German bilingual migrants similarly transferred their German alignment of prenuclear rises over into their English, or whether perhaps their German took on English patterning, could be comparatively examined. Absolute durational measurements were derived from the labels V0, C0 and C1 and expressed in ms.

The absolute difference between MIN and C0 in milliseconds (MIN_{abC0}) was calculated using the formula:

$$MIN_{abC0} = (MIN - C0) \quad (5.1)$$

The absolute difference between MIN and V0 in milliseconds (MIN_{abV0}) was calculated using the formula:

$$MIN_{abV0} = (MIN - V0) \quad (5.2)$$

The absolute difference between MAX and C1 in milliseconds (MAX_{abC1}) was calculated using the formula:

$$MAX_{abC1} = (MAX - C1) \quad (5.3)$$

Based on these formulas, the greater MIN_{abC0} , MIN_{abV0} and MAX_{abC1} were, the later the prenuclear rising accent had occurred (in absolute terms). Further specification of particularly MAX_{abC1} is given in the following section 5.2.4.

Relative tonal alignment information was also obtained. This was done because it was thought that absolute alignment may have been affected by speech rate, or segmental duration, as previously discussed in Section 5.1. The relative duration of the start of the rise was therefore calculated as the difference between MIN and C0 in relation to the total distance between C0 and C1 (MIN_{rel}):

$$MIN_{rel} = 100 \left(\frac{MIN - C0}{C1 - C0} \right) \quad (5.4)$$

The relative duration of the end of the rise was the difference between MAX and C0 in relation to the total distance between C0 and C1 (MAX_{rel}).

$$MAX_{rel} = 100 \left(\frac{MAX - C0}{C1 - C0} \right) \quad (5.5)$$

As with the absolute measures, the greater MIN_{rel} and MAX_{rel} were, the later the prenuclear rise had occurred. Based on these parameters MIN_{abC0} , MIN_{abV0} and MAX_{abC1} , as well as MIN_{rel} and MAX_{rel} were obtained for each token. This created a list of all the tokens for all of the prenuclear syllables for each speaker. These tokens were then investigated in order to investigate the hypotheses regarding group trends (see Section 5.1.1). Thereafter, interpersonal and intrapersonal variation was examined.

Again, the primary aim in this investigation was to determine whether there was a difference between the German prenuclear tonal alignment production of the experimental group and the German control group. The secondary aim was to examine whether there was a relationship between the production of German and English laterals in the bilingual group. As was the case for the lateral analysis, interpersonal as well as intrapersonal variation was investigated.

5.2.4 Inclusion of syllabic nasals

In contrast to the original study (Atterer and Ladd, 2004), tokens which contained syllabic nasals were not excluded from the present analysis. Instead, they were marked for

Bilingual group in German		German control	
Participant	Difference MAX_{abC1} (ms)	Participant	Difference MAX_{abC1} (ms)
1ExBG	-6.6	1CGGH	-8.2
2ExCL	-1.2	2CGSS	-4.8
3ExDZ	0.9	3CGHD	-0.9
4ExFS	-0.5	4CGHWS	0
5ExGB	-1.1	5CGSB	3.6
6ExIKH	-5.2	6CGDM	3.4
7ExID	5.3	7CGLH	0
8ExMZ	0	8CGHH	0.2
9ExMB	-10.9	9CGES	0
10ExRMW	0	10CGEL	0

Table 5.3: The difference between MAX_{abC1} with and without syllabic nasals. A positive number means that including syllabic nasals increased MAX_{abC1} and a negative number means that including syllabic nasals decreased MAX_{abC1} .

the prevalence of a syllabic nasal and the results from their analysis were compared with the syllables from the same speakers which contained no syllabic nasals. No substantial differences were observed when measurements were obtained including or excluding syllabic nasals.

On average, in the German of the experimental group, 9.0 tokens per participant were included in the analysis, and of these an average of 1.8 were syllabic nasals. In the German control group, an average of 9.1 tokens per participant were included in the comparison, and of these an average of 1.1 tokens were syllabic nasals. In comparison, in the original study, an average of 11.6 utterances per speaker were used in the analysis (Atterer and Ladd, 2004 : p. 184). Given that three sentences from the original study were not included in the present investigation, the rate of inclusion in the present analysis was in fact quite similar to that of the original study.

Inserting the landmark of V1 was obviously impossible in the case of syllabic nasals as the absence of a vowel is one of the defining characteristics of syllabic nasals. It was therefore decided that in order to obtain as many tokens as possible for the analysis, the distance between MAX and C1 would be investigated, rather than the distance between MAX and V1, as calculated in the study by Attner and Ladd (2004).

For the sake of comparison, in Table 5.3 the absolute difference between MAX_{abC1} when syllabic nasals were included and when they were excluded is displayed. As is evident, including syllabic nasals did not substantially impact any of these measurements (note that, as will be revealed, the average absolute duration of MAX_{abC1} in German speech was over 80 ms). On the other hand, in most participants the standard deviation was reduced (as a function of more tokens) when syllabic nasals were included.

In summary, given that when C1 was used as a reference landmark, rather than V1, including syllabic nasals did not substantially impact the results. Tokens with syllabic nasals were therefore included in the present results in order to include as many tokens as possible for each participant. This is to say that from this point on, the values displayed all included syllabic nasals.

5.3 Results

In this section, group analyses of the absolute tonal alignment results are initially presented. These are followed by the group analyses of the relative tonal alignment results, which in turn precede group analyses of absolute syllable durations. Thereafter, variation in the late consecutive bilinguals is examined. This section concludes with a discussion of the consequences of the prenuclear tonal alignment results.

5.3.1 Absolute prenuclear tonal alignment

Presently, the main objective is to report the results regarding the absolute prenuclear tonal alignment of the German of the bilingual migrants in relation to the absolute prenuclear tonal alignment of the German monolinguals. Evidence of a difference between these groups was interpreted as first language attrition at the level of prosody in the migrant group. Specifically, MIN_{abC0} , MIN_{abV0} and MAX_{abC1} were investigated. As described previously, in order to determine whether these measurements of the German bilinguals were aligned later than in the German monolingual control group, it was first necessary to ensure that the control groups differed from one another. A further objective was to investigate whether the bilinguals performed similarly, as a group, in their German and English.

In other words, the following hypotheses were initially investigated:

- Hypothesis 1a (the absolute tonal alignment of the prenuclear rise will occur significantly later in the German control group than in the English control group); and
- Hypothesis 2a (the absolute tonal alignment of the prenuclear rise will occur significantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group).

In order to investigate these hypotheses, one-way ANOVAs which included the independent variable of group (German monolinguals, English monolinguals and bilinguals in German) were performed on each dependent variable (e.g. separately for MIN_{abC0} ,

MIN_{abV0} and MAX_{abC1}). Similar to in the lateral analysis, each token went into these tests, rather than the averaged results from each participant. As already discussed, an advantage to including all tokens in the analysis was that the likelihood of a Type II error decreased. Moreover, including all tokens more adequately accounted for variability within the tokens of individual speakers, which was particularly a possibility for the bilingual participants. Arguably, a disadvantage of including all tokens was that the results may have been inflated, which increases the likelihood of a Type I error (see, for example, Field, 2005 : p. 31). However, given the argument of variation in individual speakers, it was decided that all tokens would be included in the analysis. This statistical methodology was applied to all prenuclear tonal alignment tests in the group analyses.

Unless otherwise specified, assumptions for ANOVAs were verified for each dependent variable, such as normal distributions and homogeneity of variance. MANOVAs were not conducted on the dependent variables because they were highly correlated with one another. For example, there was a highly significant positive correlation between MIN_{abC0} and MAX_{abC1} , $r = .76$, $p < .0001$. Under such conditions, it is claimed to be statistically redundant to include both combinations in a MANOVA (French et al., 2002).²

Given that the bilingual participants were measured twice (in their L1 and in their L2), a dependent t-test with the same dependent variables as above was used to investigate the following hypothesis:

- Hypothesis 3a (the absolute tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English).

In contrast to the testing of Hypotheses 1a and 2a, two-tailed significance was reported when testing Hypothesis 3a because no directional effect was predicted in the latter.

In general, the averaged absolute results of each control group, displayed in Table 5.4, suggested that the German control group aligned both the start and the end of the absolute prenuclear rise later than the English control group. These descriptive results also suggested that the bilinguals aligned, particularly the start of, the prenuclear rise (MIN_{abC0} and MIN_{abV0}) intermediately to the control groups.

More specifically, the bar chart of Figure 5.4 displays the absolute alignment of the start of the prenuclear rise, MIN_{abC0} , comparatively in the German and English of the monolinguals, and in the German and English of the bilinguals. As displayed, MIN_{abC0} of the German control group was on average the latest at just over 96 ms. In contrast,

²In comparison to the previous group analysis of F1 and F2 frequencies in the lateral phoneme /l/, the assumption of homogeneity of covariance matrices (see page 108) was met. This is to say that there was a positive correlation between the start and the end of the prenuclear rise for all groups: as, for example, MIN_{rel} increased, so did MAX_{rel} .

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
MIN_{abC0} (ms)	96.51	44.97	66.57	51.91	74.38	52.14	38.13	52.06
MIN_{abV0} (ms)	6.76	39.75	-25.88	40.52	-33.72	48.40	-63.35	60.78
MAX_{abC1} (ms)	85.64	50.46	81.61	66.97	55.46	46.19	53.60	46.80

Table 5.4: Absolute tonal alignment of prenuclear rising accents, mean and standard deviations (Stdev) from all tokens in each group.

mean MIN_{abC0} of the English control group was noticeably earlier at slightly more than 38 ms. MIN_{abC0} of the bilinguals was generally intermediate to these values; in their German slightly less than 67 ms; and in their English just over 74 ms.

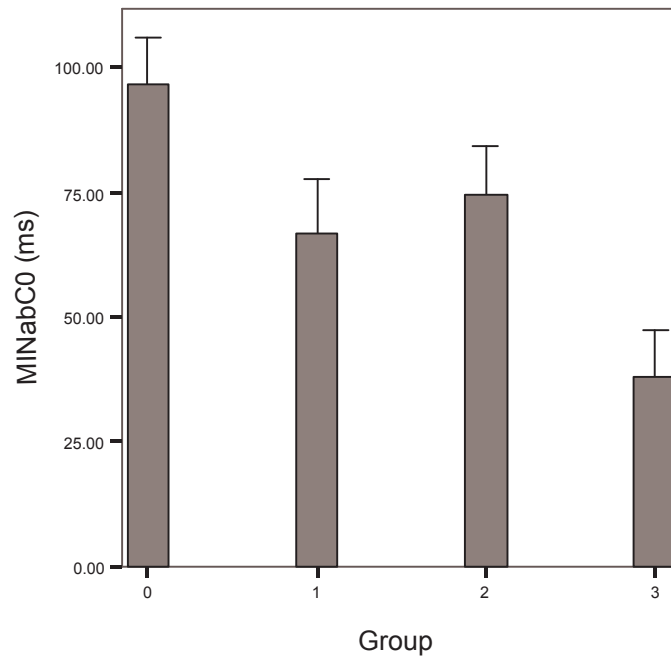


Figure 5.4: Bar chart of the mean of MIN_{abC0} for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

In fact, there was a highly significant effect of group (e.g. German monolinguals, English monolinguals and bilinguals in German) on MIN_{abC0} , $F(2,303) = 36.06$, $p < .0001$. Planned contrasts revealed that, as hypothesised, MIN_{abC0} was aligned by the German control group significantly later than by the English control group, $t(303) = -8.47$, $p < .0001$ (one-tailed), and that MIN_{abC0} was significantly earlier in the German of the

bilinguals than in the German control group $t(303) = 3.98, p < .0001$ (one-tailed). Moreover, in the dependent t-test, no significant difference was found between MIN_{abC0} in the bilinguals' German and English, $t(89) = -1.86, p = .07$ which supported the hypothesised merging effect (although the result did approach significance).

The same highly significant differences were revealed for the dependent variable of MIN_{abV0} . As documented in the bar chart of Figure 5.5, MIN_{abV0} in the German control group was on average approximately 7 ms, which suggested that there was a tendency for the start of the prenuclear rise to align with the onset of the vowel in the German monolinguals. In contrast, the mean MIN_{abV0} of the English control group was noticeably earlier at -63 ms, which suggested that the start of the prenuclear rise aligned closer to the onset of the sonorant in this group. As was the case with MIN_{abC0} , the bilinguals, as a group, aligned intermediately to these values (in their German on average -26 ms and in their English approximately -34 ms).

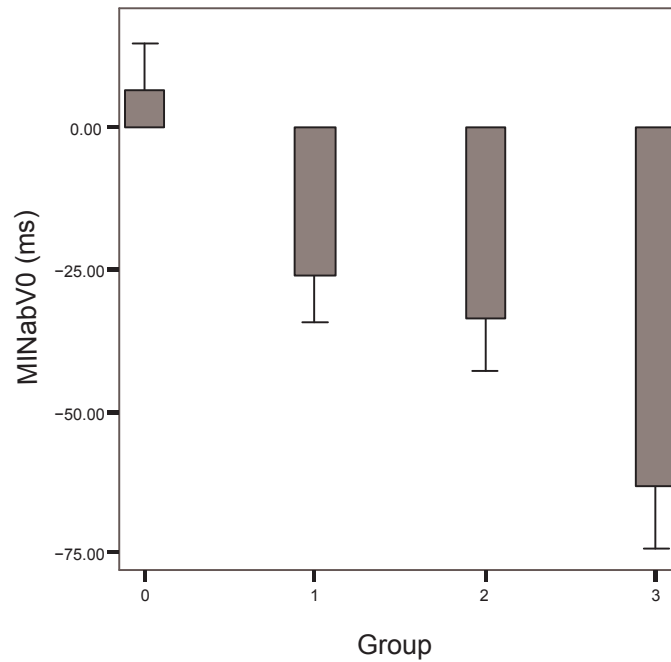


Figure 5.5: Bar chart of the mean of MIN_{abV0} for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

The Levene's test was significant for the dependent variable of MIN_{abV0} , suggesting that the assumption of equality of variances was violated, in contrast to MIN_{abC0} , although this may have been a side-effect of the relative high power of the test (Field, 2005). For

this reason, the Brown-Forsythe F is reported (Field, 2005 : p. 350). This model was again significant, revealing that there was a highly significant effect of group on MIN_{abV0} , $F(2,294) = 59.01$, $p < .0001$. Planned contrasts indicated that, as hypothesised, the German control group aligned MIN_{abV0} significantly later than the English control group, $t(212) = -10.24$, $p < .0001$ (one-tailed), and that MIN_{abV0} was significantly earlier in the German of the bilinguals than in the German control group $t(179) = -5.47$, $p < .0001$ (one-tailed). Similar to in the analysis of MIN_{abC0} , there was again no significant difference between the languages of the bilinguals, $t(89) = 0.96$, $p = .34$ which supported that MIN_{abV0} had been merged in the bilinguals.

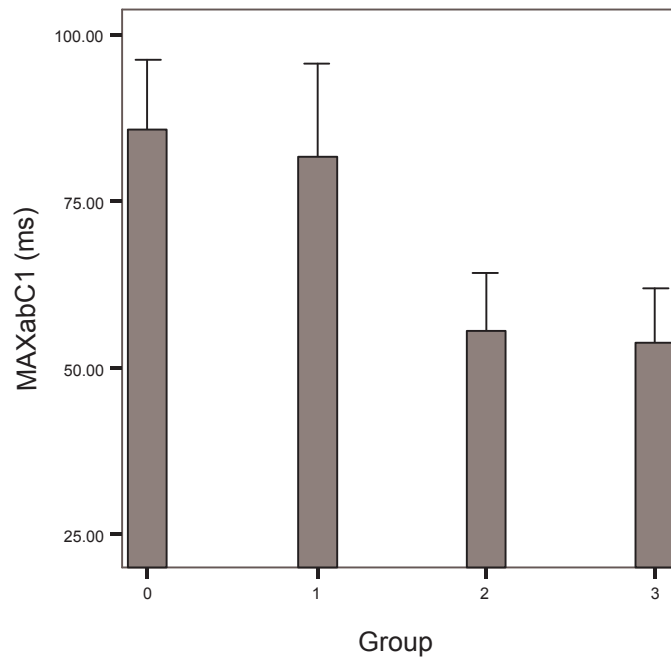


Figure 5.6: Bar chart of the mean of MAX_{abC1} for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

The bar chart of Figure 5.6 displays the absolute end of the prenuclear rise, MAX_{abC1} . As shown, MAX_{abC1} of the German control group was slightly less than 86 ms. In contrast, the English control group had an earlier averaged MAX_{abC1} of just under 54 ms. This meant that the difference between the mean MAX_{abC1} of the German control group and the mean MAX_{abC1} of the English control group was less than the difference between the means of MIN_{abC0} in these same groups (and similarly that the difference between the mean MAX_{abC1} of the German control group and the mean MAX_{abC1} of the English

control group was less than the difference between the means of MIN_{abV0} in these same groups). The bilinguals aligned the end of the prenuclear rise at approximately 82 ms in their German and at just under 56 ms in their English. It was noticeable that in each of their languages the bilingual group performed on average closer to the means of the monolingual groups, suggesting language specificity with regard to the end of the absolute prenuclear rise.

As was the case for the absolute alignment of the start of the prenuclear rise, group differences had a significant effect on MAX_{abC1} , $F(2,242) = 10.80, p < .0001$ (the Brown-Forsythe F is again reported due to the significance of the Levene test). As predicted, a planned contrast revealed that MAX_{abC1} was significantly later in the German control group than in the English control group, $t(185) = -4.75, p < .0001$ (one-tailed). However, there was no significant difference between the MAX_{abC1} of the German control group and the German of the bilinguals, $t(165) = -0.46, p = .65$ (one-tailed), contradicting the hypothesised attritional effect. Interestingly, the dependent t-test did reveal a significant difference between MAX_{abC1} in the German and English of the bilinguals, $t(89) = 3.33, p < .01$, which contradicted the hypothesis for a merging effect in the bilinguals' speech. In other words, in their German the bilinguals performed within the German monolingual norm, and no merging effect was revealed.

Summarising the results for the group analyses of absolute tonal alignment, Hypothesis 1a was verified on all accounts. In other words, MIN_{abC0} , MIN_{abV0} and MAX_{abC1} occurred significantly later in the German control group than in the English control group. This is to say that the prenuclear rising accent occurred significantly earlier in the English monolinguals than in the German monolinguals.

On the other hand, Hypothesis 2a was only partly confirmed. The dependent variables representing the start of the prenuclear rise (MIN_{abC0} and MIN_{abV0}) occurred significantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group. This was an indication of first language attrition within the prosody of the migrants. However, the end of the prenuclear rise, MAX_{abC1} , did not occur significantly earlier in the German of the bilingual migrants than in the German of the control group. This suggests that attritional effects were evidenced in the alignment of the start of the prenuclear rise, but not in the alignment of the end of the rise.

Finally, Hypothesis 3a was also only partly confirmed. Regarding the dependent variables representing the start of the prenuclear rise (MIN_{abC0} and MIN_{abV0}), there was no significant difference between the languages of the bilinguals, indicating merging effects in the L1 and L2 of the migrants. In contrast, regarding the end of the prenuclear rise, language specificity was observed on the part of the bilinguals. This meant that Hypothesis 3a, or merging, could not be confirmed for the absolute alignment of the end of the

prenuclear rise. In sum, this suggests that the late consecutive bilingual migrants - as a group - evidenced first language attrition through merging in the absolute alignment of the start, but not in the end, of the prenuclear rise.

5.3.2 Relative prenuclear tonal alignment

As already discussed, because absolute measurements do not necessary account for differences in segmental and syllable duration (for example as a result of differences in speech rate), an analysis of relative measurements was deemed appropriate. More specifically, investigating MIN_{rel} and MAX_{rel} examined the relative duration of, respectively, the start and end of the prenuclear rise in comparison to the total duration of the prenuclear syllable, which was defined as the total distance between C0 and C1 (see the following section for an analysis of absolute segmental and syllable duration). As previously discussed, the distance of the second consonant was not included in this relative calculation due to the fact that tokens including syllabic nasals had been included in the German data. The second consonant (i.e. the consonant following the vowel in the prenuclear syllable) was substantially longer when a syllabic nasal was present and syllabic nasals were only present in German. As a result, in order to adequately compare syllable duration, this was defined as the distance between the onset of the first consonant and the offset of the first vowel. Note that in relation to the English data, Ladd et al. (1999) define syllable duration according to the distance between C0 and C1, as done here.

As was the case in the absolute results section, the purpose of the present section was to determine whether tonal alignment, here in relative terms, was later in the German of the late consecutive bilingual migrants than in the German monolingual control group. In order to investigate this main objective, it was initially necessary to comparatively examine these values in the control groups. A subsequent objective was to examine whether the bilinguals performed similarly, as a group, in their German and English.

Just as had been done for the investigation of absolute prenuclear tonal alignment (see page 148), one-way ANOVA tests were performed on each dependent variable (e.g. separately for MIN_{rel} and MAX_{rel}) between the three groups of German monolinguals, English monolinguals and the bilingual migrants in their German. Again, each token went into these tests, rather than the averaged results from the individual participants. This meant that the following hypotheses were tested using ANOVAs in the present section:

- Hypothesis 1b (the relative tonal alignment of the prenuclear rise will occur significantly later in the German control group than in the English control group); and
- Hypothesis 2b (the relative tonal alignment of the prenuclear rise will occur sig-

nificantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group).

As previously performed in the absolute analysis, dependent t-tests were used to investigate the following hypothesis:

- Hypothesis 3b (the relative tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English).

The averaged relative results of each control group, displayed in Table 5.5, once again revealed that the German control group aligned prenuclear rising accents - here relatively - later than the English control group. There was also a trend for the bilinguals to align particularly the relative start of the prenuclear rise intermediately in comparison with the control groups.

	German Monolinguals		Bilinguals in German		Bilinguals in English		English Monolinguals	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
MIN_{rel}	54.18	21.46	35.13	25.33	37.36	25.33	18.83	24.42
MAX_{rel}	149.89	27.37	146.14	36.86	130.37	24.85	128.33	30.08

Table 5.5: Relative alignment of prenuclear rising accents, mean and standard deviations (Stdev) from all tokens in each group.

More specifically, as evident in the bar chart of Figure 5.7, MIN_{rel} in the German control group was on average slightly more than 54% whereas in the English control group, it was just under 19%. MIN_{rel} of the bilinguals was on average just over 35% in their German and in their English approximately 37%. There was a highly significant effect of group on MIN_{rel} , $F(2,303) = 57.91$, $p < .0001$. As predicted in the hypotheses, planned contrasts revealed that the German control group aligned the relative start of the prenuclear rise significantly later than the English control group, $t(303) = -10.75$, $p < .0001$ (one-tailed), and that MIN_{rel} occurred significantly earlier in the German of the bilinguals than in the German control group $t(303) = -5.37$, $p < .0001$ (one-tailed). Similar to the absolute results, there was again no significant difference between the relative alignment of the start of the prenuclear rise in the languages of the late consecutive bilinguals, $t(89) = -1.42$, $p = .16$. These relative results confirmed the absolute analysis of the alignment of the start of the prenuclear rise: an attritional effect in the German of the bilingual migrants and a merging effect in the bilinguals' L1 and L2.

Table 5.5 also reports the relative alignment of the end of the prenuclear rise, MAX_{rel} . As comparatively displayed in Figure 5.8, MAX_{rel} was again on average later in the

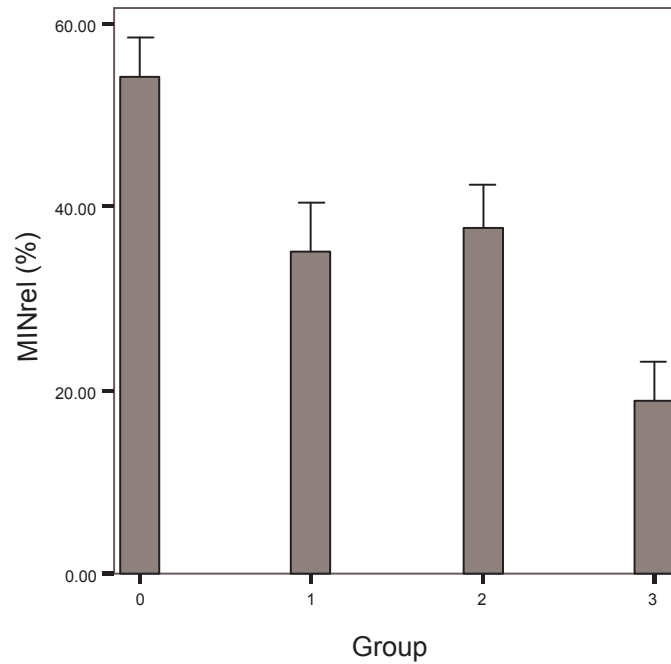


Figure 5.7: Bar chart of the mean of MIN_{rel} for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

German control group (approximately 150%) than in the English group (approximately 128%). In comparison, the relative tonal alignment of the end of the rise in the bilinguals was just over 146% in their German and in their English just under 130%. Similar to in the results for the absolute analysis of prenuclear tonal alignment, this meant that the difference between the mean MAX_{rel} of the German control group and the mean MAX_{rel} of the English control group was less than the difference between the means of MIN_{rel} in these same groups. There was again a highly significant effect of group on MAX_{rel} , $F(2,303) = 14.93$, $p < .0001$. The first hypothesis was verified in the planned contrast, revealing that the German control group aligned the end of the prenuclear rise significantly later than the English control group, $t(303) = -4.97$, $p < .0001$ (one-tailed). However, as was the case for the absolute analysis, the second hypothesis was not verified, e.g. MAX_{rel} did not occur significantly earlier in the German of the bilinguals than in the German control group $t(303) = -0.74$, $p = .46$ (one-tailed). The third hypothesis was also not verified in the planned contrast. In other words, there *was* a significant difference between MAX_{rel} in the German and English of the bilinguals, $t(89) = 3.80$, $p < .0001$. These results similarly confirmed the results of the absolute analysis in that no attritional

effect was evidenced regarding the alignment of the *end* of the prenuclear rise, nor was a merging effect evidenced in the language of the bilinguals.

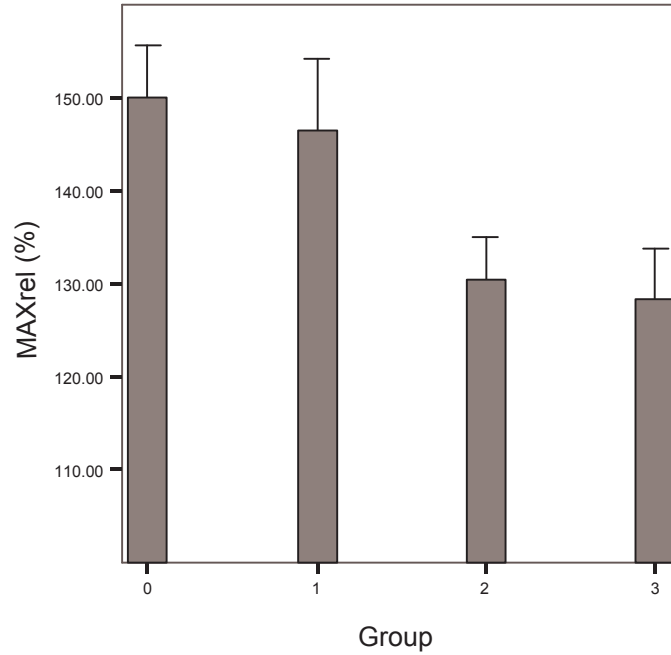


Figure 5.8: Bar chart of the mean of MAX_{rel} for the four groups (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars show 95.0% CI of mean.

In sum, the results for the group analysis of relative prenuclear tonal alignment confirmed the results of the analysis of absolute prenuclear tonal alignment. This is to say that in terms of relative tonal alignment, Hypothesis 1a was again verified on all accounts; MIN_{rel} and MAX_{rel} occurred significantly later in the German control group than in the English control group. Moreover, Hypothesis 2a could only partly be confirmed. The relative start of the prenuclear rise, MIN_{rel} , occurred significantly earlier in the native German speech of the bilinguals than in the German speech of the monolingual control group, but the end of the prenuclear rise, MAX_{rel} , did not occur significantly earlier in the German of the bilinguals than in the German of the control group. Likewise, Hypothesis 3a was also only partly confirmed. Regarding the relative start of the prenuclear rise, there was no significant difference between the languages of the bilinguals, suggesting merging effects and hence confirming Hypothesis 3a. In contrast, regarding the relative end of the prenuclear rise, language specificity was again observed on the part of the bilinguals. These results again confirmed that the late consecutive bilinguals displayed first language

attrition in the form of merging effects with regard to the alignment of the start of the prenuclear rise, but not with regard to the alignment of the end of the prenuclear rise.

5.3.3 Segmental and syllable duration

The results of the previous sections indicated that there were significant differences in the absolute and relative tonal alignment of prenuclear rises in the German and English control data and that these differences were to a certain extent reflected in the form of first language attrition in the late consecutive bilinguals. Although both absolute and relative tonal alignment results were similar, it was nevertheless possible that segment and syllable duration influenced tonal alignment patterning. Atterer and Ladd (2004) directly address this possibility: “Conceivably, there is even a causal link between the later alignment [in Southern German speakers] and the relatively longer vowel, though at this point, we have no way of knowing what that link might be” (p. 187). The question for the present investigation was therefore whether segment and syllable duration may have, first of all, differed at all in the data, and if so, whether these differences may potentially have explained differences in either - or both - of the absolute and relative tonal alignment results. It was for this reason that the syllable and segmental durations of the participants were also investigated in a follow-up analysis.

	German Control		Bilinguals in German		Bilinguals in English		English Control	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
Absolute syllable (ms)	175.24	34.58	178.17	38.32	195.66	42.15	207.23	46.85
Absolute consonant (ms)	89.74	22.92	92.45	28.59	108.10	30.20	101.48	26.84
Absolute vowel (ms)	85.50	20.09	85.72	22.24	87.56	37.01	105.75	44.30
Relative vowel (%)	48.90	7.71	48.40	9.10	43.82	13.18	49.71	12.97

Table 5.6: Absolute duration of the prenuclear syllable (ms), absolute duration of the consonant and vowel in the prenuclear syllable (ms), and relative duration of the vowel. Mean and standard deviations (Stdev) from all tokens in each group are presented.

First off, the absolute duration of the prenuclear syllable was investigated (the first consonant and the first vowel in the prenuclear syllable, or C1 minus C0 in ms, the same distance on which the relative tonal alignment was based). Again, all tokens were entered into this test, rather than the means from each participant (refer to page 148 for statistical justification). Thereafter, the absolute duration of the consonant in the prenuclear syllable

was investigated, followed by the absolute duration of the vowel. Finally, the relative duration of the vowel was investigated in relation to the total duration of the prenuclear syllable. The averaged results from these descriptive analyses are displayed in Table 5.6.

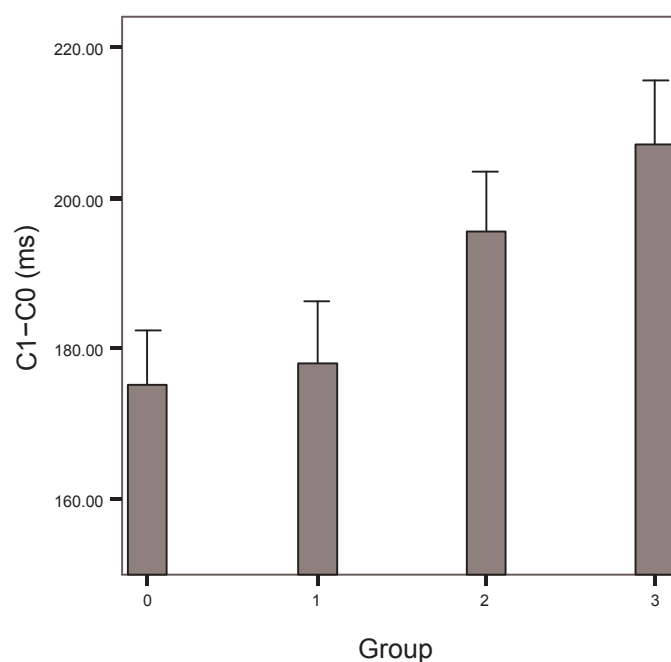


Figure 5.9: Bar chart of the absolute duration in ms of C1 minus C0 (defined as syllable duration) for each group (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars for each group show 95.0% CI of mean.

As is evident from Figure 5.9, the prenuclear syllable of the English control group was on average *longer* than in the other groups. More specifically, the mean duration of the prenuclear syllable in the German control group was 175 ms; in the English control group 207 ms; in the German of the bilinguals 178 ms; and in the English of the bilinguals 196 ms. There was a highly significant effect of group (German monolinguals, the English monolinguals, and the German migrants in their German) in the ANOVA which investigated the duration of the prenuclear syllable, $F(2,301) = 21.84$, $p < .0001$. The post-hoc Tukey HSD test revealed that this effect was predominantly driven by language specificity. In other words, there was no significant difference between the German of the control group and the German of the bilinguals. There were, however, significant differences between the two monolingual control groups, and between the English monolinguals and the bilinguals in German. Moreover, in the dependent t-test, a significant difference was revealed between the languages of the bilinguals, $t(89) = -3.12$, $p < .001$.

These results indicated that, in terms of absolute prenuclear syllable duration, the German of the bilinguals was no different from the German monolingual control group: both were significantly shorter than the English control group. Interestingly, because the syllable duration of the English control group was longer than the syllable duration of the German control group, *shorter* syllable duration was associated with a *later* alignment of the prenuclear rise - at least in terms of the control groups. In contrast, the syllable duration of the German migrants (in their German) stayed the same as the syllable duration of the German control group, but the alignment of the start of prenuclear rise on the part of the former was nevertheless earlier. In relation to the absolute and relative tonal alignment results, these initial results suggest that tonal alignment differences regarding the start of the prenuclear rise were in fact present in the German of the bilingual migrants, as reported in the previous sections, and that these differences in alignment were not a function of variation in absolute syllable duration.

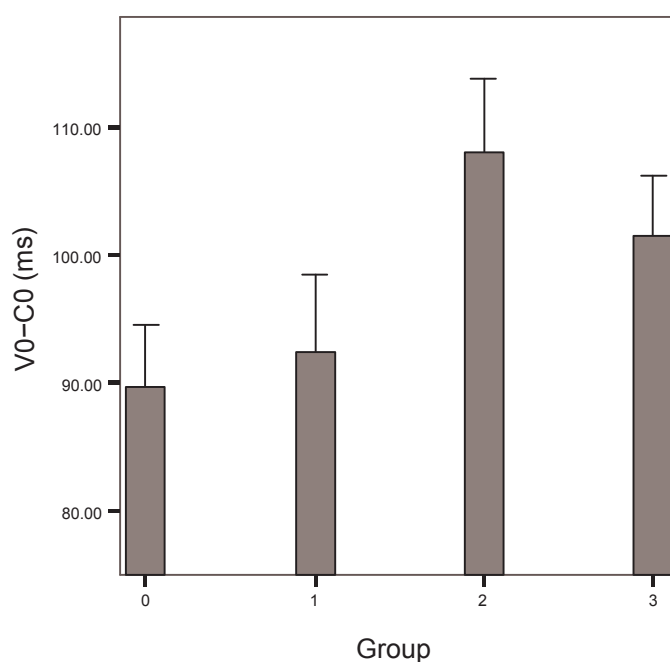


Figure 5.10: Bar chart of the absolute duration in ms of V0 minus C0 for each group (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars for each group show 95.0% CI of mean.

As reported in Figure 5.10, further attention was directed specifically towards the absolute duration of the first consonant (C0 minus V0 in ms). A one-way ANOVA test investigated whether the duration of this particular segment differed across the groups.

This was done because although durational differences regarding the prenuclear syllable did not account for the earlier absolute alignment of the prenuclear rise in the German of the bilinguals (in comparison to the German control group), if the first consonant in this syllable was significantly longer in the German control group, this may have accounted for the later absolute alignment of particularly MIN_{abV0} in the German control group. Again, there was a significant effect of group on the duration of the first consonant, $F(2,303) = 6.02, p < .01$. More specifically, the post-hoc Tukey HSD test revealed that the mean duration of the first consonant for the German control group was at 90 ms significantly shorter than of the English control group at 102 ms and that there was no difference between the bilinguals in their German and the German control group. In the German of the bilinguals the mean duration of the first consonant was 93 ms and in the English of the bilinguals the mean duration of the same consonant was 108 ms, and the dependent t-test again revealed a significant difference between the languages of the bilinguals, $t(89) = -4.10, p < .0001$. This was once more an indication of the differences in tonal alignment between the German of the late consecutive bilingual migrants and the German control group being due to a function of prosodic differences and not of differences in duration, here segmental.

The next test examined differences in duration of the first vowel of the prenuclear syllable (C1 minus V0 in ms). This test was performed because it is conceivable that a significantly longer vowel in the prenuclear syllable of the German control group may have accounted for the later absolute alignment in the same group. Here the Brown-Forsythe F is reported due to the significance of the Levene test. This test indicated that there was again a highly significant effect of group on the duration of the first vowel, $F(2,245) = 16.73, p < .0001$. The post-hoc Tukey HSD test revealed that this difference was solely driven by the English monolingual control group which had a significantly longer mean vowel duration than both other groups (see Figure 5.11). No other significant differences were revealed. More specifically, the mean duration of the first vowel in both the German control group and the German of the bilinguals was 86 ms. In contrast, the mean duration of the first vowel in the prenuclear syllable of the English control group was 106 ms. The bilinguals in English, who were not included in the ANOVA test, revealed a mean duration of 88 ms. The dependent t-test revealed that the duration of the vowel in the bilinguals' English was not significantly longer than the duration of the vowel in their German, $t(89) = -0.31, p = .76$.

In accordance with the previous results, this was again evidence for segmental duration being the same in the German of the control group and the German of the late consecutive bilinguals. This confirmed that both relative and absolute differences in tonal alignment between these groups could not have been causally linked with absolute dif-

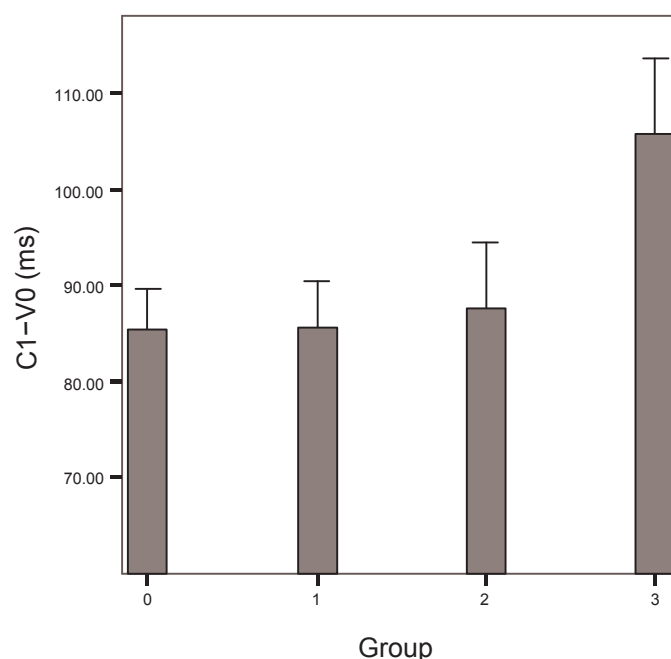


Figure 5.11: Bar chart of the absolute duration in ms of C1 minus V0 for each group (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars for each group show 95.0% CI of mean.

ferences in segmental and syllable duration and that there was in fact a general tendency for the late consecutive bilinguals to align the start of their prenuclear rise closer to the onset of the first consonant in the prenuclear syllable, and hence earlier than the German control group.

Recall, however, that Atterer and (2004) Ladd suggest that there may be a causal link between later alignment and “the relatively longer vowel” (p. 187). In other words, although the absolute duration of the vowel did not differ in the data, the relative duration of the vowel may have differed. When this relative duration was investigated, the groups did not have a significant effect on the duration of the relative duration of the vowel in the prenuclear syllable, $F(2,303) = 0.42$, $p = .66$ (see Figure 5.12). More specifically, the relative duration of the vowel in the prenuclear syllable (compared with the total duration of the prenuclear syllable) in the German control group was 49%; in the German of the bilinguals 48%; and in the English monolinguals 50%. Interestingly, the relative duration of the vowel in the bilinguals’ English (44%) was significantly shorter than the relative duration of this segment in the bilingual’s German, $t(89) = 3.09$, $p < .01$.

If this information is related to the results for prenuclear tonal alignment, this meant

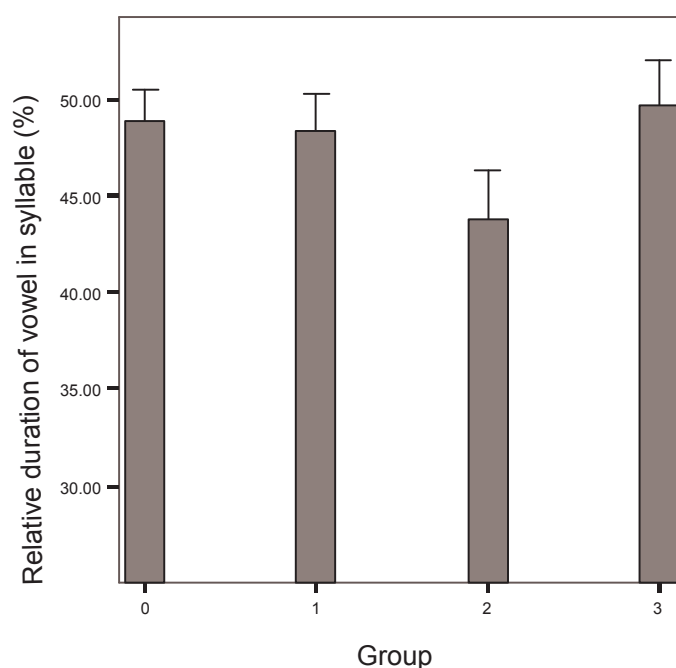


Figure 5.12: Bar chart of the relative duration (%) of the first vowel in relation to the total duration of the first consonant and the first vowel (or syllable duration) for each group (0 = German controls; 1 = Bilinguals in German; 2 = Bilinguals in English; 3 = English controls). Error bars for each group show 95.0% CI of mean.

that in terms of the control groups, there was no significant difference in relative vowel duration. Alternatively, because the control groups *did* vary in absolute durations, it is conceivable that there was a causal link between the later alignment (of the German control group in comparison to the English control group) and the absolute *shorter* syllable of the German control group. Note that this would be the reverse to the link mentioned by Atterer and Ladd (2004) in their reference to relative durations. Simply put, in the present data, shorter syllable duration coincided with *later* tonal alignment (in German) and longer syllable duration coincided with *earlier* tonal alignment (in English).

Crucial for the purpose of the present investigation, the syllable duration of the German control group and the German of the bilinguals was not significantly different, and yet the start of the prenuclear rise aligned significantly earlier in the German of the bilinguals than in the German control group. In combination with the results of the previous sections, this is a relatively clear indication of first language attrition at the level of prosody within the German of the late consecutive bilingual migrants. In other words, earlier alignment of the start of the prenuclear rise on the part of the bilinguals was not caused by

differences in syllable duration because the syllable duration of the German control group and the bilinguals in their German was the same.

Summarising, syllable and segmental durations in the German of the late consecutive bilinguals did not significantly differ from the German control group. This means that an earlier start of the prenuclear rise in the German of the late consecutive bilinguals in comparison with the German of the control group could indeed be interpreted as evidence of first language attrition at the level of prosody.

5.3.4 Bilingual variation in prenuclear tonal alignment

The previous analysis examined group trends and did not differentiate between individuals, nor examine individual participants on their own. In the present section, closer examination was directed towards variation in the tonal alignment of the late consecutive bilingual migrants. It was of interest to examine whether some bilinguals may have displayed language specificity in tonal alignment in either or both of their languages. For the sake of consistency, absolute tonal alignment is presented initially, and thereafter relative tonal alignment.

Variation in absolute prenuclear tonal alignment

In this section, attention was directed towards the variation of absolute tonal alignment of the prenuclear rise within the L1 and the L2 of the bilinguals. For example, it was of relevance to ask whether *each* bilingual displayed merging effects (with regard to the start of the prenuclear rise), or whether the intermediate means of the absolute start of the prenuclear rise were potentially a result of averaging effects. More precisely, the aim was to investigate within each individual:

- Hypothesis 3a (the absolute tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English).

In Figure 5.13 the means of MIN_{abC0} and MAX_{abC1} for each participant are displayed in a scatterplot. The bilingual participants are named in this scatterplot, whereas the participants of the monolingual control groups are not (due to lack of space).

Firstly, it is evident from this scatterplot that the differences between the German and English control groups, discussed in the previous results section, are revealed here as well. This is to say that there are more English monolinguals towards the lower ends of the axes representing MIN_{abC0} and MAX_{abC1} than towards the higher ends. In contrast, there are more German monolinguals towards the higher ends of the MIN_{abC0} and MAX_{abC1}

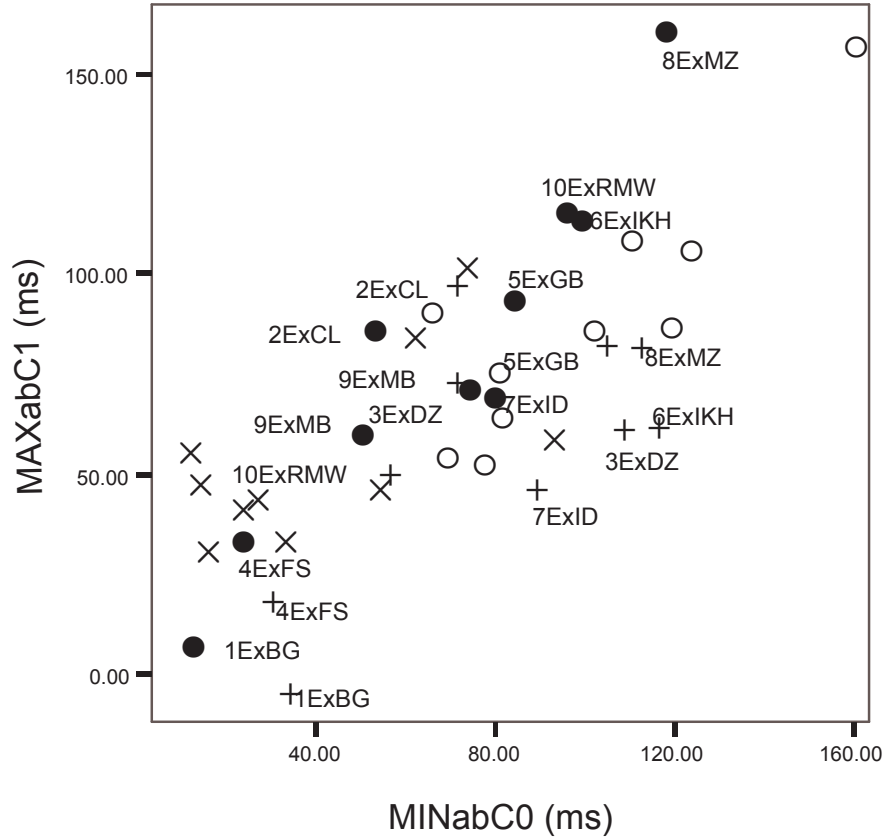


Figure 5.13: Scatterplot of MIN_{abC0} against MAX_{abC1} . The mean of MIN_{abC0} and MAX_{abC1} of each participant is displayed. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

axes. Crucially, the means for MIN_{abC0} and MAX_{abC1} of the individual participants in the monolingual groups overlap with one another on both axes. This suggests that absolute tonal alignment is non-categorical in German and English (as also proposed by Atterer and Ladd, 2004), which in turn has consequences for the interpretation of variation between the L1 and the L2 of the bilinguals.

Specifically addressing Hypothesis 3a, from Figure 5.13 it is evident that the mean absolute tonal alignment of the prenuclear rise was similar in both the German and the English of *some* of the bilinguals. (The exact means and standard deviations for the start and the end of the absolute prenuclear rise for each bilingual participant are displayed in Table 5.7.) For example, it is evident from the scatterplot that MIN_{abC0} and MAX_{abC1} of participants 1ExBG, 2ExCL, 4ExFS, 5ExGB and 9ExMB are similar in both their

German and English. In contrast, MIN_{abC0} of participant 6ExIKH remained the same in both German and English, whereas MAX_{abC1} was markedly later in her German than in her English. Participant 8ExMZ performed similarly to 6ExIKH. This is to say that her MIN_{abC0} was similar in German and English, whereas MAX_{abC1} was noticeably later in her German than in her English. Participant 7ExID also had a later MAX_{abC1} in her German than in her English although MIN_{abC0} in her German and English were similar. Participant 10ExRMW displayed both a later MIN_{abC0} and MAX_{abC1} in her German than in her English. These latter participants (in particular 6ExIKH, 8ExMZ, 7ExID and 10ExRMW) displayed to varying extents language specificity in the absolute alignment of prenuclear rising accents. In particular participant 10ExRMW performed within the monolingual range in both her L1 and L2. On the other hand, the mean of MIN_{abC0} for participant 3ExDZ was surprisingly later in his English than in his German, and MAX_{abC1} was similar in both his languages.

With regard to the former participants (1ExBG, 2ExCL, 4ExFS, 5ExGB and 9ExMB), who displayed similar absolute tonal alignment in German and English, it was of interest to determine whether their absolute prenuclear rising accent corresponded more clearly to the German or the English monolingual (non-categorical) norm. The late consecutive bilinguals 1ExBG and 4ExFS performed quite clearly in both their German and English within the results of the English monolingual controls. Participant 2ExCL also tended to display a somewhat early MIN_{abC0} in both German and English. Participant 5ExGB performed within both the German and English range of absolute tonal alignment, as did participant 9ExMB, although the latter bilingual migrant tended more towards the English range in both of her languages.

Summarising the analysis of bilingual variation in tonal alignment, it can be said that some late consecutive bilinguals displayed language specificity with regard to absolute prenuclear tonal alignment, whereas others evidenced similarities in the tonal alignment of their first and second language. Notably, not all bilinguals displayed merging effects for the start of the prenuclear rise - some clearly performed within the English monolingual norm, whereas others clearly performed within the German norm. In the case of the end of the prenuclear rise, some consecutive bilinguals evidenced language specificity, whereas others indicated merging effects. Given that the absolute tonal alignment of the monolingual groups overlapped, the ramifications of such merging effects deserve more attention, as discussed in final section of this chapter.

	MIN_{abc0} (ms)				MIN_{abv0} (ms)				MAX_{abc1} (ms)			
	German Mean	German Stdev	English Mean	English Stdev	German Mean	German Stdev	English Mean	English Stdev	German Mean	German Stdev	English Mean	English Stdev
1ExBG	10.03	16.53	31.67	35.15	-58.65	15.18	-60.70	31.65	7.04	20.72	-5.13	42.43
2ExCL	50.29	29.17	69.01	31.71	-24.88	21.69	-38.24	38.87	86.15	34.03	97.32	40.66
3ExDZ	71.42	58.22	106.34	71.08	-39.28	27.77	-47.12	32.51	70.74	32.19	60.83	51.62
4ExFS	20.86	26.96	27.74	38.29	-60.91	9.60	-74.27	27.08	32.93	27.37	18.14	46.06
5ExGB	81.39	41.92	102.22	37.06	-16.42	35.46	-17.62	42.05	93.11	44.54	81.95	22.58
6ExIKH	96.89	39.07	114.01	30.34	16.67	35.37	8.51	26.21	113.33	52.88	61.50	15.80
7ExID	77.24	50.78	86.81	62.70	-10.85	40.71	-21.20	59.23	69.11	71.67	46.33	30.56
8ExMZ	115.35	57.26	110.24	36.85	-7.81	43.08	-15.98	43.14	160.82	118.81	81.75	27.12
9ExMB	47.65	53.14	68.83	48.13	-42.81	52.32	-27.58	60.74	59.79	39.18	73.03	33.24
10ExRMW	93.50	37.39	53.73	46.46	-15.39	47.95	-42.08	46.53	115.29	48.90	49.96	38.19

Table 5.7: Mean and standard deviation of the absolute tonal alignment (MIN_{abc0} , MIN_{abv0} and MAX_{abc1}) of the bilingual participants in German and English.

Variation in relative prenuclear tonal alignment

Closer examination was directed towards variation in the alignment of relative prenuclear rises in the late consecutive bilingual migrants. As was the case in the previous section, the aim was to investigate whether some bilinguals may have displayed the evidenced language specificity in relative tonal alignment in either or both of their languages. The precise objective was to, within each bilingual, investigate:

- Hypothesis 3b (the relative tonal alignment of the prenuclear rise will be the same in the bilinguals' German and English).

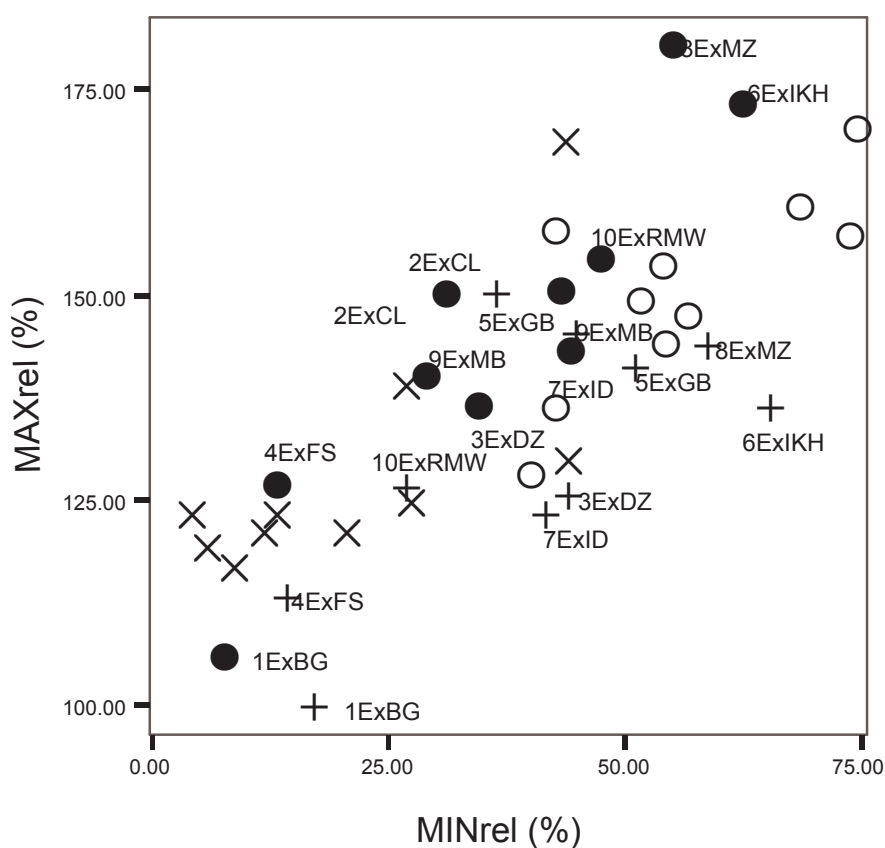


Figure 5.14: Scatterplot of MIN_{rel} against MAX_{rel} . The mean of MIN_{rel} and MAX_{rel} of each participant is displayed. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

The differences between the German and English control groups were again evidenced in the scatterplot documenting the relative tonal alignment. In fact, the differences be-

tween the control groups in the relative data appeared to be slightly more language specific than the differences displayed in the absolute data. The English monolinguals were more concentrated towards the lower ends of the axes representing MIN_{rel} and MAX_{rel} and the German monolinguals were more concentrated towards the higher ends of these axes.

In terms of Hypothesis 3a, from Figure 5.14 it was evident that, as was the case for the absolute data, for the most part, the mean relative tonal alignment of the prenuclear rise was similar in both the German and the English of the bilinguals. (The precise means and standard deviations for the start and the end of the relative prenuclear rise for each bilingual participant are displayed in Table 5.8.) In fact, these merging effects were slightly more clear with regard to the relative data in comparison to the absolute values. Specifically, the bilingual participants 1ExBG, 2ExCL, 3ExDZ, 4ExFS, 5ExGB and 9ExMB all performed similarly in their German and English. The previously observed difference between the MIN_{abc0} of participant 3ExDZ was reduced in the relative data. The differences observed in the absolute data of participant 7ExID were also reduced in the relative data. In other words, for these participants, Hypothesis 3a was substantiated. The question therefore became whether the merged prenuclear rising accents were more within the German or English monolingual norm. Participants 1ExBG and 4ExFS performed in both of their languages more within the English monolingual norm than within the German monolingual norm. For the other participants, the merged variable was still within the norm of the German monolingual control, although towards the cuff of this range.

In contrast, participants 6ExIKH and 8ExMZ did not display merging in the alignment of their prenuclear rising accent. MIN_{rel} of participant 6ExIKH remained the same in both German and English, whereas MAX_{rel} was again noticeably later in her German than in her English. Participant 8ExMZ performed similarly, MIN_{rel} was similar in German and English, whereas MAX_{rel} was noticeably later in her German than in her English. Participant 10ExRMW most clearly displayed language specificity in both her L1 and L2 for both the start and the end of the prenuclear rise.

Summarising bilingual variation of relative tonal alignment in prenuclear syllables, it can be stated that in general Hypothesis 3b could be confirmed, although this was more so the case for start of the rise (MIN_{rel}) than the end of the rise (MAX_{rel}). Only one participant (10ExRMW) displayed language specific realisations of relative tonal alignment which corresponded to the monolingual norms of this study.

	MIN_{rel} (%)				MAX_{rel} (%)			
	German		English		German		English	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
1ExBG	5.86	9.33	15.48	16.00	105.88	13.10	99.76	21.36
2ExCL	29.47	17.21	34.70	16.48	150.17	17.95	150.27	22.32
3ExDZ	32.85	18.61	42.39	21.38	136.55	16.51	125.54	23.71
4ExFS	11.41	14.65	12.42	14.87	126.87	24.33	113.21	26.86
5ExGB	41.47	17.71	49.52	14.67	150.43	27.84	141.01	13.68
6ExIKH	60.70	22.33	63.78	17.01	173.31	35.96	136.13	14.99
7ExID	42.65	25.60	40.05	27.03	143.25	40.64	123.13	15.43
8ExMZ	53.39	24.01	56.98	13.53	180.67	66.13	143.76	14.90
9ExMB	27.22	29.06	43.07	28.90	140.32	21.16	145.32	20.12
10ExRMW	45.83	18.21	25.17	23.45	154.42	20.02	126.41	22.49

Table 5.8: Mean and standard deviation (Stdev) of the relative tonal alignment (MIN_{rel} and MAX_{rel}) of the bilingual participants in German and English.

5.3.5 Intrapersonal variation

Presently, the focus is on intrapersonal variation in the relative alignment of the prenuclear rise in the late consecutive bilingual migrants. These results relate closely to those of Section 5.3.4; however the focus here is on whether some bilingual migrants may have evidenced first language attrition in, for example, the start of the rise, but not in the end of the rise, or *vice versa*.

In Figure 5.15, MIN_{rel} in the German and English of the bilinguals is displayed. The top horizontal line represents the German control group's mean MIN_{rel} , and the error bars correspond to the standard deviation of this group. The complementary bottom horizontal line represents the English control group's mean MIN_{rel} . In Figure 5.16, MAX_{rel} in the German and English of the bilinguals is documented. The configuration of both figures is the same. When the alignment of the start and end of the prenuclear rises are compared with one another in the German of the late consecutive bilingual migrants, different intrapersonal trends can be observed. For example, participants 1ExBG and 4ExFS were clearly within the range of the English control group for both MIN_{rel} and MAX_{rel} . Participants 2ExCL and 9ExMB appeared to be closer to the English monolingual range for MIN_{rel} , but not for MAX_{rel} . In contrast, participant 3ExDZ was closer to the English monolingual norm for MAX_{rel} but not for MIN_{rel} . Participants 5ExGB, 7ExID and 10ExRMW were closer to the German control results with regard to both MIN_{rel} and MAX_{rel} . In comparison, participants 6ExIKH and 8ExMZ seemed to overshoot the German monolingual norm for MIN_{rel} and were clearly within this control group's norm for MAX_{rel} .

One may summarise these results by concluding that intrapersonal variation with re-

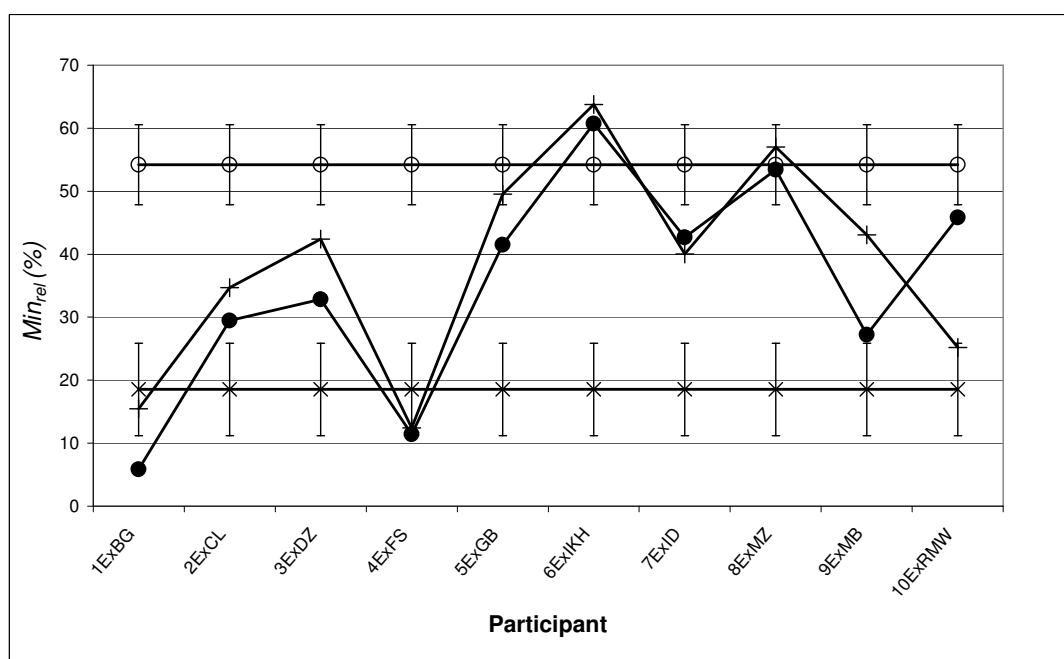


Figure 5.15: MIN_{rel} in the L1 and L2 of the bilinguals in relation to the monolingual norms. The top horizontal line displays the mean of the German monolinguals (average standard deviation displayed by the intersecting vertical lines). The bottom horizontal line displays the mean of the English monolinguals (average standard deviation displayed by the intersecting vertical lines). The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

gard to the analysis of the alignment of the relative prenuclear rise was evident in the late consecutive bilingual migrants.

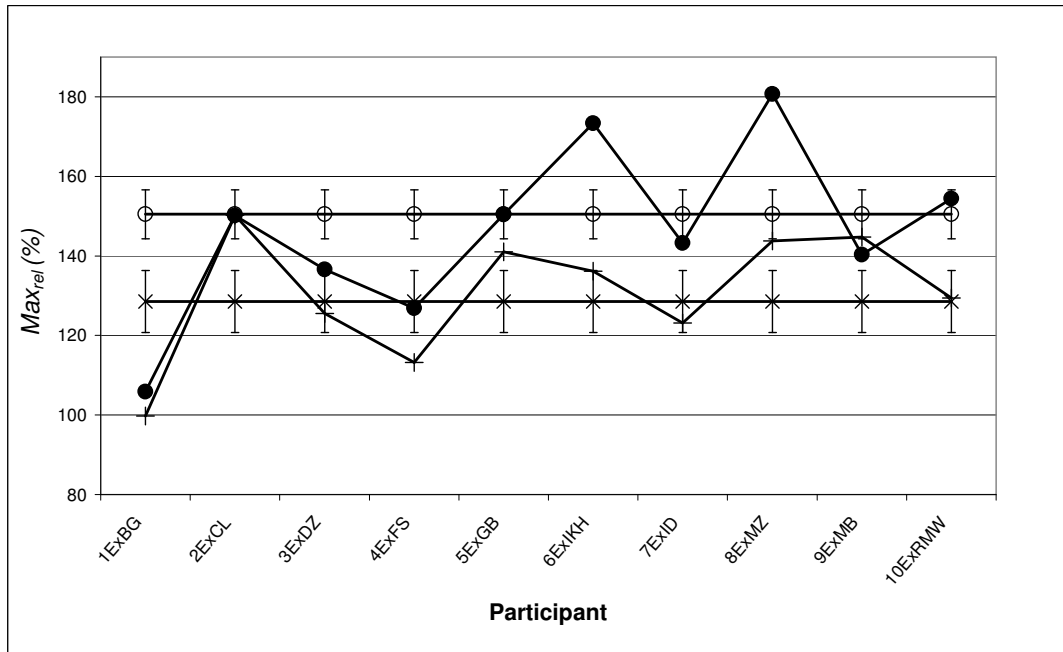


Figure 5.16: MAX_{rel} in the L1 and L2 of the bilinguals in relation to the monolingual norms. The top horizontal line displays the mean of the German monolinguals (average standard deviation displayed by the intersecting vertical lines). The bottom horizontal line displays the mean of the English monolinguals (average standard deviation displayed by the intersecting vertical lines). The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

5.3.6 Interpersonal variation and predictor variables

Given that the late consecutive bilinguals displayed interpersonal variation regarding the first language attrition in tonal alignment in prenuclear syllables, predictor variables were examined to see whether these may have influenced the individual results of the participants. As already mentioned, the predictor variables included in this analysis were age of arrival, length of residence, amount of contact with the German language and type of contact with German. MIN_{rel} evidenced most clearly the effects of first language attrition and for this reason correlation tests were performed on this variable. The mean of each bilingual participant (in German) went into these Pearson's correlation tests.

As predicted, a significant relationship between MIN_{rel} and AOA was reported, $r = .73, p < .01$ (one-tailed). In other words, the earlier the AOA, the earlier the start of the prenuclear rise aligned, or, in terms of first language attrition, the more first language attrition was evident in the prosody of the native German speech of the bilinguals. This relationship is displayed in Figure 5.17. It should be noted that this result was significant in accordance with the Bonferroni correction, hence given that four correlation tests were performed, at the $\alpha - level$ of .013.

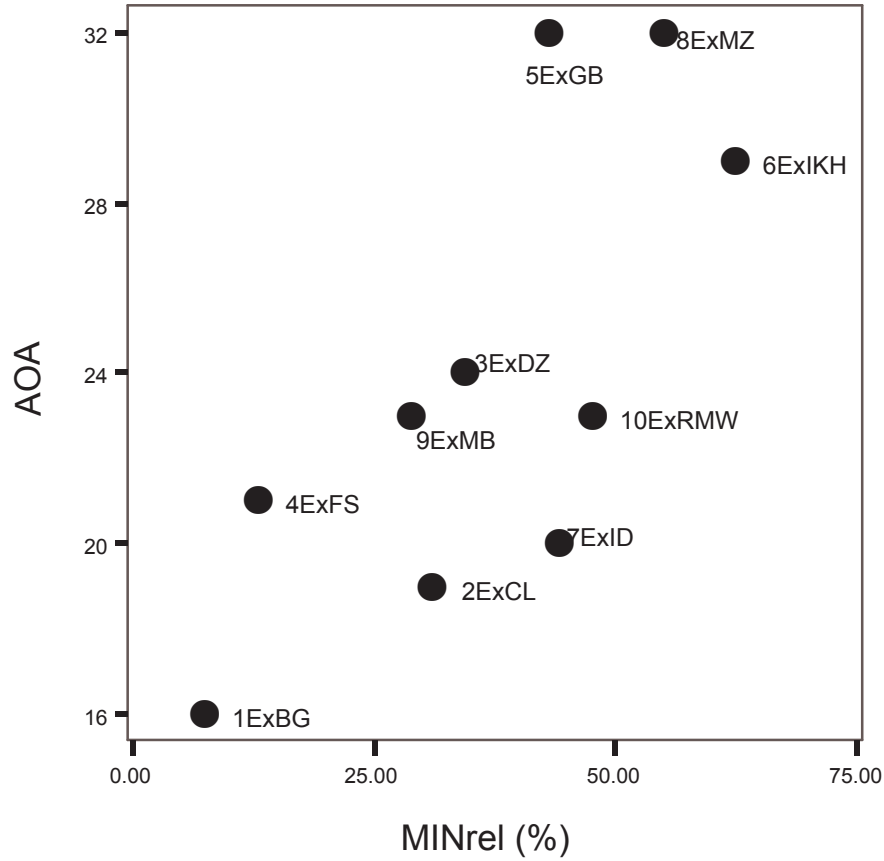


Figure 5.17: Scatterplot of AOA against MIN_{rel} in the German of the bilingual migrants.

Thereafter, length of residence was investigated in a one-tailed correlation test. The prediction was that a longer length of residence would correlate with more first language attrition, or an earlier MIN_{rel} . This test was not significant, $r = -.43$, $p = .11$ (one-tailed). Interestingly, the direction of the effect was the opposite to that of length of residence in the lateral analysis. Here a longer length of residence was perhaps associated with more first language attrition.

Neither was a significant correlation detected between MIN_{rel} and amount of contact with the German language, $r = .19$, $p = .30$ (one-tailed), nor between MIN_{rel} and type of contact, $r = .06$, $p < .43$ (one-tailed). In the latter two correlation tests, one-tailed significance was reported because the prediction was that higher contact values would be associated with more first language attrition.

In a final analysis, the alignment of the end of the prenuclear rise was examined. Here the prediction was the same as that for the alignment of the start of the prenuclear rise.

Similarly, there was a significant relationship between MAX_{rel} and AOA, $r = .77, p < .01$ (one-tailed). This positive correlation again suggested that the earlier the late consecutive bilingual migrants arrived in Canada, the more likely they were to undergo first language attrition in the prosody of their native German language. This was particularly interesting because although as a group there had been no significant difference between MAX_{rel} in the German of the control group and the German of the bilingual migrants, those of the latter group who evidenced an earlier MAX_{rel} were more likely to have arrived at an earlier age in Canada.

In sum, age of arrival to Canada proved to be the only significant predictor variable in determining first language attrition in the realisation of prenuclear rising accents in the late consecutive bilingual migrants.

5.4 Discussion of tonal alignment analysis

Summarising the first set of hypotheses, it was verified that both the absolute and relative tonal alignment of the prenuclear rise occurred significantly later in the German control group than in the English control group. These findings coincide with the results of the previous study by Atterer and Ladd (2004). Moreover, in the present study, there was overlapping within the monolingual groups for both the start and the end of the rise. This is to say that although German tonal alignment occurred later than English tonal alignment, prenuclear tonal alignment in German and English cannot be considered to be categorical. These findings correspond to Atterer and Ladd's (2004) general conclusion of their own results which "argue against interpreting cross-language alignment differences in terms of distinct patterns of phonological association, and in favor of describing them in terms of quantitative phonetic realization rules" (p. 177).

Similar to the results by Atterer and Ladd (2004), it was revealed in the present study that the difference between the start of the prenuclear rise across the control groups was greater than the difference between the end of the rise. As will be discussed, this finding has ramifications for the interpretation of the bilinguals' results. Finally, here as a side note, with regard to the first set of hypotheses, an additional finding from the study at hand is that prenuclear tonal alignment is earlier in *Canadian* English than in German. In this way, the results contribute to the body of research into dialectal variation of tonal alignment.

In terms of the second set of hypotheses, the data could only be partly verified. Both the relative and absolute start of the prenuclear rise occurred significantly earlier in the German of the late consecutive bilinguals than in the German of the control group. How-

ever, neither the relative nor absolute end of the prenuclear rise occurred earlier in the German of the bilinguals than in the German control group. In other words, first language attrition in the form of L1 and L2 merging was evident in the prosody of the bilingual migrants regarding the *start* of the prenuclear rise, but not regarding the *end* of the rise.

If an attempt is made to apply these results to the Speech Learning Model (SLM), the findings are intriguing. This is because the SLM hypothesises that similar segmental items will be more difficult to acquire than dissimilar segmental items. Given that MIN_{rel} of German and English contrasted more than MAX_{rel} in German and English, one would predict, in line with the SLM, that MAX_{rel} would be more difficult to acquire than MIN_{rel} . Accordingly, more merging would be expected in the phonetic variable of MAX_{rel} than in MIN_{rel} . In fact, the opposite was true. Late consecutive bilinguals underwent first language attrition - as a group - of MIN_{rel} , but not of MAX_{rel} . Given that the difference between the start of the prenuclear rise across the control groups was greater than the difference between the end of the rise, one can moreover conclude that it was in particular the aberration from the German monolingual norm in the start of the rise on the part of the bilingual migrants which would with all likelihood be perceivable by German monolinguals. It is therefore highly likely that however tempting, the SLM indeed makes predictions for solely segmental items of speech, and that it is not applicable to suprasegmental or prosodic elements of speech, at least as evidenced here.

The final set of hypotheses was conducted through two statistical analyses. Initially, the group analyses of individual variation regarding the German and English of the late consecutive bilinguals was conducted. Here merging effects were revealed for the onset of both the absolute and relative prenuclear rise in the German and English of the bilingual migrants. However, the group comparisons also revealed that the end of both the absolute and relative prenuclear rise in German and English were significantly different from one another. This meant that, as a group, merging was evidenced for the alignment of the beginning, but not of the end, of the prenuclear rise in the late consecutive bilingual migrants. These findings confirmed the attritional effects revealed through the testing of the second set of hypotheses.

When variation was examined with regard to language specificity on the part of the bilinguals, it was revealed that most participants displayed a merged alignment of the prenuclear rising accent in their German and English. This is to say that for most bilingual migrants, the alignment of the prenuclear rise was similar in their L1 and their L2. In particular the participants 1ExBG and 4ExFS displayed a merged prenuclear rising accent in German and English which was within the English monolingual norm, hence for these participants, first language attrition was most clearly evidenced. In contrast, only one participant, 10ExRMW, displayed a prenuclear rising accent which was conducive to the

monolingual norms in both her German and English.

Predictor variables were examined in order to explain interpersonal variation of first language attrition within the late consecutive bilingual migrants. Here an earlier age of arrival was correlated with an earlier alignment of the prenuclear rise. In other words, late consecutive bilinguals who moved to Canada at a younger age were more likely to perform within the English monolingual norm in their German than those who arrived to Canada at a later age.

Finally, when intrapersonal variation was examined in the German of the migrants, it was revealed that some individuals displayed first language attrition in both the start and the end of the prenuclear rise, whereas others were more likely to display first language attrition either within the start or within the end.

In summary, these findings suggest first language attrition in the German of the late consecutive bilingual migrants with regard to the start of their prenuclear rise, but not with regard to the end of the rise. Moreover, not all bilingual migrants displayed first language attrition in their native German. It appeared that age of arrival to Canada significantly influenced the alignment of the prenuclear rise. Migrants who had arrived earlier in Canada were more likely to perform English-like in their prenuclear rise.

Chapter 6

L1 attrition of pitch range in German

6.1 Pitch range in German and English

This chapter documents the final production analysis of Experiment II, that of pitch range. More specifically, differences in the realisation of pitch range in German and English form the basis of this part of the production analysis into first language attrition.

Firstly, it is necessary to define pitch. Pitch *per se* is a perceptual property, whereas fundamental frequency (F0) is generally investigated as its acoustic correlate. Hayward (2000) summarises: “In principle, it is important to distinguish between frequency, which is a measurable characteristic of sounds as they exist in the physical world, and pitch, which is a psychological attribute of sounds and exists only in the mind” (p. 27). The reason why the physical property is differentiated from the percept is that there is not a linear relationship between the two. Auditory filters in the ear make frequency resolution become poorer as frequency increases (see amongst others Hayward, 2000 and Moore, 1989). For example, “it is possible to detect a difference between 100 Hz and 103 Hz, but not between 4000 Hz and 4003 Hz” (Hewlett and Beck, 2006 : p. 213). Despite this difference between pitch and F0, the two terms are often used synonymously and unless otherwise specified this will be the case here too. This is on the one hand because much of the previous literature uses the terms rather synonymously, and also because it is claimed that the frequencies which are the focus of this investigation occur within the lower frequency range of the band-pass auditory filter. These frequencies, characteristic of normal speech, are therefore in fact more likely to be perceived linearly.

Pitch *range*, as a percept, has been further characterised using the terminology of *pitch level* and *pitch span* (Ladd, 1996). Pitch level has been defined as “the overall pitch height and span reflects how much pitch varies within a given speech sample” (Mennen et al., 2007 : p. 1770). Although there are numerous techniques used to quantify pitch range,

the mean or median of F0 has been used as an acoustic correlate of pitch level (Patterson, 2000; Mennen et al., 2008). Particularly regarding pitch span, there is debate over the process of quantification (Patterson, 2000; Mennen, 2007; Mennen et al., 2008), which will be further explored in Section 6.2. However, regardless of the preferred technique, in most cases pitch span is expressed in semitones (ST) (consult Hewlett and Beck, 2006 : pp. 124 - 125 for a more detailed explanation of the conversion of Hertz into semitones), and pitch level is expressed in Hertz (Hz).

An analysis of pitch range enables speaker differentiation. For instance, it is possible to characterise the voice of a speaker on the basis of his or her pitch level, it being perceived as either high or low. Speaker specific anatomical differences impact an individual's pitch level, e.g. males generally have thicker and longer vocal folds which result in a lower fundamental frequency or pitch level (Laver, 1980; Neppert, 1999; Hayward, 2000). As will be approached at the end of this section, anatomical changes due to the process of aging may also impact fundamental frequency. Moreover, it has been claimed that speakers may habitually *adopt* a pitch range (Laver, 1980). In other words, pitch range is anatomically determined, but it can also be influenced by the speaker (whether this is done knowingly or not is another question).

Recently it has been suggested that pitch range may be language specific (Willems, 1982; van Bezooijen and Gooskens, 1999; Scherer, 2000; Mennen et al., 2007). For the purpose of the present investigation, it is important to document differences in pitch range between German and English, which is the present focus. Eckert and Laver (1994) noted that differences in pitch range between German and English are reflected in German media. Specifically, they suggested that the German voice-over for an American sitcom has a noticeably lower pitch level than the original actress. Gibbon (1998) similarly reported differences in pitch range between German and English and noted that these differences may lead to German speakers being perceived as 'bored' or 'unfriendly' by British listeners. Alternatively, English speakers may be regarded as 'aggressive' by German listeners (Gibbon, 1998). Surprisingly, an early study by Scherer (1979) indicated that German male speakers tend to be perceived as having a somewhat higher pitched voice than their American English counterparts.

In addition to these perceptual, or observational reports, recent instrumental research has compared pitch range in German and English (Scharff, 2000; Mennen, 2007; Mennen et al., 2007). An initial study by Scharff (2000) looked at the speaking fundamental frequency of female monolingual speakers of British English and German who were between 20 and 40 years of age (the monolingual English speakers were from Newcastle-upon-Type, whereas those in Germany were from the Stuttgart area). These monolingual speakers functioned as two respective control groups and were compared with an ex-

perimental group of German-English bilinguals (native German speakers who had been living in the U.K. on a long-term basis). The study revealed that the German monolinguals had a significantly lower speaking fundamental frequency than the English monolinguals. Moreover, it was reported that the German native speakers displayed less frequency variation than their English counterparts (which suggests a more narrow pitch span on the part of the former). In line with the monolinguals' results, the bilinguals used a significantly higher pitch level in English than they did in German. Crucial to the present research, the bilinguals' pitch level in both of their languages was on average intermediate to the monolinguals'.

Mennen (2007) analysed a subsequent set of similar data from the same speakers and found that there was a clustering of the native German speakers at the lower end of pitch span, whereas the English speakers clustered at the higher end. With regard to level, there was a tendency for a higher pitch level in English than in German, but this did not reach significance in her study (Mennen, 2007). In another study by Mennen et al. (2007), female speakers of Northern Standard German and Southern Standard British English were investigated. Here it was found that the former had a narrower pitch span than the latter (Mennen et al., 2007). With regard to pitch level, there was more interpersonal variation in the British English speakers than in the German monolinguals. Interestingly, they also investigated German native speakers who were learning English as an L2 and reported that the majority of the English L2 learners only adjusted pitch level in their L2 (a higher pitch level was evident in their L2 speech than in their L1 speech), rather than pitch span (Mennen et al., 2007). An alternative explanation regarding the higher pitch span in English may have been that the German native speakers' cognitive workload was higher in their L2, and some research suggests that there is a positive correlation between cognitive workload and an increase in F0 (Johnstone and Scherer, 1999; Mendoza and Carballo, 2003). This would explain a rise in pitch level in the English L2 speakers of Mennen et al. (2007), but it probably would not explain the reported differences between English and German native speakers.

If these studies (Eckert and Laver, 1994; Gibbon, 1998; Mennen, 2007; Scherer, 1974; Mennen et al., 2007; Scharff, 2000) are summarised, the results suggest that English and German tend towards language specificity in the realisation of pitch range. More specifically, at least in the females examined in the discussed studies, it may be that a narrower pitch span and a lower pitch level is characteristic of German speech, whereas a wider pitch span and a higher pitch level is characteristic of English speech.

At this point it is important to emphasise that the speakers in all of the instrumental studies reported were females in early to mid-adulthood. Moreover, only a small range of dialects in the given languages were investigated and controlled for. In contrast, as

already discussed, the speakers in the present study into first language attrition were older (at least in chronological age), there were men and women, and their dialects did not solely represent those of the previous studies into pitch range in German and English. As such, the results of the previously discussed studies are potentially only partly applicable to the participants of the present study.

In particular, given that the average age of the participants in the present study was older than that of the participants in the previously discussed studies, the impact of age on pitch range is relevant. Some research suggests that the process of aging affects F0 (Linville, 1996; Nishioa and Niimi, 2008). As summarised by Linville (1996), male speaking fundamental frequency “lowers from young adulthood into middle age and then rises again into old age” (p. 191). Based on the diagrams of her study, this means that male F0 may raise from approximately 110 Hz at 30 years of age to approximately 130 Hz at 70 years of age. In fact, according to her diagram, a steep incline in speaking fundamental frequency occurs after 70 years of age. This is to say that the F0 range between 70 and 90 years of age lies on average between 120 and 145 Hz, whereas between 20 and 70 years of age the F0 range is lies on average between 100 and 120 Hz (Linville, 1996; Nishioa and Niimi, 2008). In women, on the other hand, speaking fundamental frequency “appears to remain fairly constant until menopause when a drop in fundamental frequency (F0) occurs” (p. 191). Once menopause has occurred, F0 thereafter remains quite stable (Linville, 1996). More specifically, according to the diagram by Linville (1996), there appears to be a drop in frequency of between 20 and 30 Hz between the age of 40 and 50. Although only one language group (American English speakers) was investigated in these studies, the results are interpreted as a function of anatomical and physiological changes (atrophy of muscle tissue, larynx lowering, weakening of structural support in men, and hormonal changes in women, as explored in Linville and Rens, 2001), rather than as a function of vocal control (Linville, 1996). Presumably, the results are therefore applicable to speakers of German, as well as to the bilingual participants in the present investigation. This means that because age was controlled for in the participants of the present study, each bilingual participant being matched with two control participants within the same age range (see page 79), the effects would be the same in all groups. However, given that there was a concentration of older speakers in the study at hand (the youngest bilingual migrant was 41 and the oldest was 80 years of age), the same language specific effects may not have been evidenced as those reported in the other instrumental studies (Scharff, 2000; Mennen, 2007; Mennen et al., 2007). In other words, it is conceivable that language specificity of pitch range may be evident in younger subjects, but not in older subjects as anatomical changes progress. To date there has been no study on changes in language specificity as a function of age. Still, or perhaps because of this, pitch range was explored

as it was likewise conceivable that that this prosodic characteristic may indeed reveal first language attrition.

In addition to changes in pitch level, pitch span may also change over time. For example, it has been reported that fundamental frequency standard deviation values during sustained vowel production increase in both men and women as a function of age (Linville, 1996). This measurement, as a quantification of pitch span, was twice as high in elderly male speakers than in younger male adults (Orlikoff, 1990). In women, pitch span more than doubled from young adulthood to old age (Linville and Fisher, 1985). These findings were (similar to pitch level changes) interpreted as a result of the biological process of aging, rather than as a result of vocal control. Again it is for this reason that the results of the present study may need to be cautiously compared with the previously discussed studies, indicating language specificity on the part of younger participants (Scharff, 2000; Mennen, 2007; Mennen et al., 2007).

It should also be highlighted that both men and women were examined in the present study, whereas in those which exposed differences in the pitch range of German and English native speakers, only women took part. Here again, it may be that the differences reported by Scharff (2000), Mennen (2007) and Mennen et al. (2007) are not applicable to German and English *men*. Particularly the previously mentioned study by Scherer (1979) suggests that German men may have a higher pitch level than American English men. This observation directly contradicts the expected difference between German and English females.

Moreover, dialectal variation may play a role in intonation (Ulbrich, 2002), and conceivably also pitch range. Here the literature is sparse, but given that dialectal variation was largely controlled for in the present study, it seems justifiable to assume that the effects would have been similar in both the experimental and control groups. Still, such variation suggests that caution must be heeded in relating the results of the previously discussed studies (Scharff, 2000; Mennen, 2007; Mennen et al., 2007) to those of the present study.

As a final note on prudence, it is possible that any clear patterns regarding language specificity may have been suppressed by between-speaker differences in affective states and personality traits (Scherer, 2003). Although a relatively emotionally neutral story was chosen for the pitch range task, as will be discussed in the following section, which presumably would have muffled any particular emotions, the speakers may still have differed in their emotional states (independent of the story). In other words, the small group of speakers in the present study may not have been able to account for these interpersonal differences within the groups.

Summarising, although the discussed studies predominantly investigated young fe-

male native speakers, their results warranted an investigation into first language attrition in the pitch range of the present participants because the general conclusion was that pitch range tends towards language specificity in German and English. Accordingly, the question of the present study was whether the German migrants to Anglophone Canada would display a pitch range similar to that of the German control group, or perhaps evidence a more English-like pitch range in their German. Moreover, as was the case in the preceding two production analyses of Experiment II, English L2 acquisition of pitch range in the German migrants was investigated in relation to L1 attrition of this phonetic variable.

6.1.1 Hypotheses

Given the information described above, the following hypotheses were tested. As discussed in the previous section, these hypotheses were expected to be more clear in women than in men (Scherer, 1979; Scharff, 2000; Mennen, 2007; and Mennen et al., 2007).

1. First set - control groups

- (a) The German monolingual control group will have a significantly lower pitch level than the English monolingual control group.
- (b) The German monolingual control group will have a significantly more narrow pitch span than the English monolingual control group.

2. Second set - first language attrition

- (a) The German bilingual migrants will have a significantly higher pitch level than the German monolingual control group.
- (b) The German bilingual migrants will have a significantly wider pitch span than the German monolingual control group.

3. Third set - merging effects

- (a) Pitch level will be the same in both of the bilinguals' languages.
- (b) Pitch span will be the same in both of the bilinguals' languages.

6.2 How was pitch range measured?

As was the case in the preceding production analyses, this section describes the presentation of the pitch range task, as well as the procedure used to measure and compare pitch range.

6.2.1 Presentation

The pitch range task was the last task during the interviews with the participants. There was a short break after the tonal alignment task, which preceded the pitch range task. It was again the case with the pitch range task that in line with Grosjean's (2001) description of language modes, the German pitch range task took place in the German language half, and the English pitch range task in the English half.

The participants were initially shown the one-page story (which was the pitch range task and will be discussed shortly) in their respective language. At this point it was explained that they were to first read the story to themselves. If they had any questions about the story after reading it, they were free to ask. In all cases the participants had no questions about the story. This was probably because the story was quite simplistic (please see Appendix D.1 for the German story and Appendix D.2 for the English story). In contrast to the lateral and tonal alignment tasks, the pitch range task was on a piece of paper, and the participants held the piece of paper while they were reading. Before the recording began, the positioning of the participant was adjusted so that it was possible for him or her to hold the piece of paper as well as be recorded. It was politely asked of the participant to not make noise with the paper during the recording, but the impression was that the participants felt better holding the paper. Before the recording of the pitch range task began, the participant was also invited to repeat a sentence if they happened to misread it during the recording. Once the participants had read the story to themselves and felt that they were ready, they said that they were ready, and this is when the actual recording began. Reading the story out loud took approximately two minutes. This, in addition to the preparations beforehand, took approximately 7 minutes in total. The duration of each task was the same in both languages.

The story which was chosen for the pitch range task was the same as that which had been chosen by Mennen et al. (2007). This was called the 'Dog and Duck' story and the English version had originally been used by Brown and Docherty (1995). For the cross-linguistic comparison, the English story was translated and slightly adapted for German (Mennen et al., 2007). The story was considered to be a useful measure of pitch range because an equal amount of direct and indirect speech occurred in both texts. It was also characterised by a large amount of voicing, which is necessary in order to extract pitch. Moreover, the story had previously been found to be the most effective task for read speech in determining cross-linguistic differences in the pitch span of German and English speakers (Mennen et al., 2007).

6.2.2 Annotation

Annotation was not necessary in the analysis of pitch range.

6.2.3 Measuring pitch range

Pitch level was measured with Praat, using the analysis settings as recommended in the Praat manual (please see below). For pitch span, the difference between the 90th and 10th percentile range (80% Range) in semitones (ST), interquartile range (IQR) (i.e. the limits within which the middle 50% of an ordered set of observations fall (Field, 2005)) in ST, and ± 2 standard deviations around the mean (SD4) in ST, were obtained. For pitch level, mean and median F0 (Hz) were measured. These measurements were chosen based on the results of Mennen et al. (2007), in which the same techniques were used and differences between German and English speakers were revealed. Other methodologies, such as those by Patterson (2000), were not implemented because they had previously been found to be less successful in detecting differences in pitch range between German and English native speakers. In particular it was reported by Mennen et al. (2008) that the methodology of Patterson (2000) could not be applied to German speech in a straightforward manner because phrase-initial accent peaks rarely occur in German. This is to say that linguistically based pitch range measures, as used by Patterson (2000), were not effective in determining cross-linguistic pitch range differences, at least in native German and English speech (Mennen et al., 2008).

The analysis settings described in the Praat manual were adhered to. This was on the one hand because after listening to the participants, it was observed that values specified in the Praat manual in general characterised the voices of the participants. Moreover, in an initial analysis of F0 minimum and maximum of the participants, the values fell within the Hz values specified by Praat. Accordingly, for women pitch floor was set to 100 Hz while the pitch ceiling was set to 500 Hz. For men, pitch floor was set to 75 Hz while the ceiling was set to 300 Hz.

Based on these settings, a number of different values related to pitch range were obtained, as specified above. More specifically, mean and median F0 in Hz, 80% Range in ST, IQR in ST, and SD4 in ST were measured based on the recordings from the story. The first of these values represented pitch level, whereas the latter were various quantifications of pitch span. Although in the study by Mennen et al. (2007), they found that “the measures of the difference between the 90th and 10th percentile (in semitones), and ± 2 standard deviations around the mean in ST differentiate the groups of speakers in the direction predicted by the stereotypical beliefs described in the literature about German

and English speakers” (Mennen et al., 2007 : p. 1770), for the sake of thoroughness, all methods of measurement were included in the present analysis of pitch range.

For each speaker these values were transferred directly to SPSS and statistical tests were conducted in order to determine whether group differences were apparent. As already described, the primary aim of this analysis was to determine whether there was a difference between the German pitch range production of the experimental group and the German control group.

6.3 Results

In the results section of pitch range, group analyses of pitch level is initially undertaken and thereafter, group analyses of pitch span. This is followed by an investigation into bilingual variation in pitch level, and then in pitch range. Predictor variables are looked at subsequently. The final section of the pitch range results focuses on intrapersonal variation in the late consecutive bilingual migrants.

6.3.1 Pitch level

The objective of this section was to investigate whether the pitch level of the German of the bilingual migrants, as a group, was higher than the pitch level of the German monolinguals, as a group. As specified in the hypotheses, it was expected that this trend would be more evident in the female participants than in the males (Scharff, 2000; Mennen, 2007; Mennen et al., 2007), particularly because the results from the study by Scherer (1979) suggested that the pitch level of American English men tends to be lower than that of German men. Both the mean and median F0 were investigated in the analysis of pitch level, expressed in Hz.

Testing whether there was a significant difference between the pitch level of the experimental and control groups was conducted separately for the male and female participants. Non-parametric tests were chosen for these analyses because a number of assumptions for parametric tests were not met. In particular, the assumption of homogeneity of variance, as indicated by Levene’s test, was violated. Moreover, the sample sizes were too small to adequately verify whether the data were normally distributed. Separate analyses of mean F0 and median F0 were conducted using the Kruskal-Wallis test. The aim of these tests was to investigate group variation with regard to:

- Hypothesis 1a (the German monolingual control group will have a significantly lower pitch level than the English monolingual control group); and

- Hypothesis 2a (the German bilingual migrants will have a significantly higher pitch level than the German monolingual control group).

The Wilcoxon signed-rank test, a non-parametric test used to examine situations in which there are two sets of scores from the same participants, was used to investigate merging effects in the bilingual migrants, or more specifically:

- Hypothesis 3a (pitch level will be the same in both of the bilinguals' languages).

From Table 6.1, it appears that there was a tendency for the pitch level of the German monolingual females to be lower than that of the English monolingual females. Specifically, the averaged mean F0 of the German females was approximately 185 Hz, whereas the averaged mean F0 of the English females was just over 198 Hz. Likewise, German females had an averaged median F0 of approximately 177 Hz, whereas the English females' median F0 was just under 191 Hz. In comparison with the control groups, there appeared to be a tendency for the female bilinguals to pattern intermediately with regard to mean F0 (average of 193 Hz in German and 194 Hz in English). In other words, bilingual German females seemed to have on average a slightly higher mean F0 than did the monolingual German females, but the mean F0 of the bilingual females was not quite as high as the average mean F0 of the English females.

However, the Kruskal-Wallis tests for mean F0 and median F0 in females were not significant (respectively, $H(2) = 1.09, p = .58$ and $H(2) = 1.44, p = .49$). This meant that neither Hypothesis 1a nor 2a could be verified for the female participants. In other words, no significant difference was reported between the pitch level of the control groups, nor between the German of the late consecutive bilinguals and the German control group.

The Wilcoxon signed-rank tests, which tested for merging effects in the languages of the bilinguals, were also not significant for mean F0, $z = -.69, p = .94$; and median F0 $z = -.51, p = .69$.¹ These results appeared to support Hypothesis 3a; however, because no significant difference between the German and English control females was reported, the lack of difference between the languages of the bilingual females could not be attributed to the merging of language specific differences. Instead, it is more likely that the similarity in the L1 and the L2 of the bilinguals was a result of speaker specificity.

From Table 6.1, it is also noticeable that there was less variation with regard to pitch level in the female German control group than in the female English control group. For example, the standard deviation of mean F0 for the female controls in German was just

¹Two-tailed significance is reported because there was no significant difference in the control groups. This was similarly the case in the rest of the pitch range analysis when no significant difference occurred between the control groups.

			Mean F0 (Hz)	Median F0 (Hz)
German Monolinguals	Females	Mean	185.01	177.04
		Stdev	18.18	17.92
	Males	Mean	126.50	124.47
		Stdev	15.86	16.00
Bilinguals in German	Females	Mean	192.97	187.61
		Stdev	19.50	18.87
	Males	Mean	148.30	142.37
		Stdev	25.90	25.86
Bilinguals in English	Females	Mean	193.77	186.59
		Stdev	21.01	18.87
	Males	Mean	146.70	141.70
		Stdev	21.20	23.61
English Monolinguals	Females	Mean	198.32	190.63
		Stdev	27.09	27.51
	Males	Mean	116.88	114.98
		Stdev	14.58	15.26

Table 6.1: Pitch level of bilingual migrants and control groups. Mean and median F0, as well as standard deviation (Stdev) in Hz are displayed.

over 18 Hz, whereas in English it was slightly more than 27 Hz. Moreover, there was more variation in the bilingual females' pitch level in both English and German than in the German females' pitch level, as will be discussed in Section 6.3.3. These differences of within-group interpersonal variation in mean F0 are displayed in the boxplots of Figure 6.1. At the moment, it is worth emphasising that the within-group variation of the English monolingual females was rather greater than the within-group variation of the German monolingual females.

Interestingly, the opposite tendency was observed in the male controls, German males having on average a higher pitch level than English males. More specifically, German males had an averaged mean F0 of almost 127 Hz, whereas the averaged English males' mean F0 was just under 117 Hz. A similar difference of almost 10 Hz was observed regarding the median F0 of the male controls, respectively, approximately 124 Hz versus 115 Hz. Surprisingly, the bilingual males' mean F0 was higher (average of 148 Hz in German and 147 Hz in English) than that of both male control groups.

In contrast with the analyses of the females, the Kruskal-Wallis tests performed on the pitch level of the male speakers were closer to reaching significance (for mean F0, $H(2) = 5.07$, $p = .09$; however, for median F0, $H(2) = 3.47$, $p = .20$). In other words, although for mean F0 significance was approached, Hypothesis 1a and 2a could not be verified for men. Lack of significance may quite possibly have been impacted by the small group of male participants.

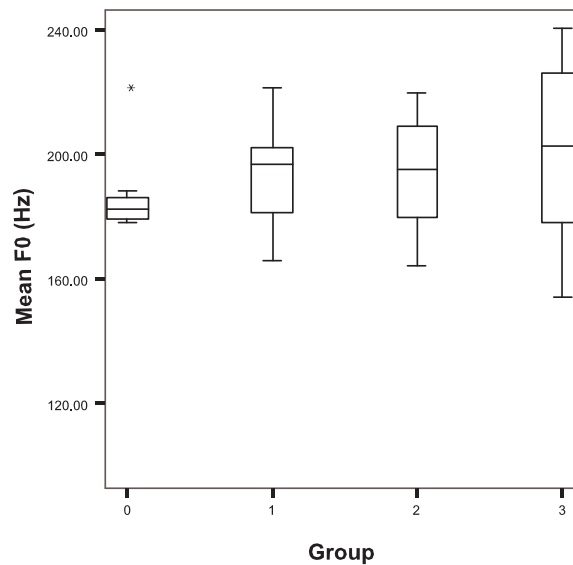


Figure 6.1: Boxplots of mean F0 for the female participants of the four groups (0=German controls; 1=Migrants in German; 2=Migrants in English; 3=English controls).

The Wilcoxon signed-rank tests, which compared the languages of the bilinguals, was also not significant for both the mean F0 of the bilingual men, $z = -.54$, $p = .75$ and median F0, $z = -.54$, $p = .75$ (two-tailed significance is again reported, consult the footnote on page 185). Nevertheless, it should be emphasised that because no significant difference between German and English control males was reported, it is not possible to attribute the lack of difference between the L1 and the L2 of the bilingual males to merging effects. Their averaged results in fact suggested that the bilingual males' pitch level was not intermediate to the control males'. Alternatively, the similar results in the bilingual males' L1 and L2 can be more adequately explained by speaker specificity.

In sum, these findings suggest either that the groups investigated were too small in size to detect any potential language specific differences in pitch level, or, that pitch level is language *inspecific* in German and English. Following the latter interpretation, the reported averaged differences were most likely a result of speaker specificity. Given that no language specific differences were revealed between the control groups, it was in fact effectively impossible to measure both first language attrition and merging effects in the bilingual migrants. Still, it is interesting to note that language specific trends in the pitch level of the control groups were the opposite for women and men.

6.3.2 Pitch span

The next analysis of pitch range examined pitch span. More specifically, it was investigated whether a wider pitch span would be produced by the German bilingual migrants in their German speech than in the German speech of the monolingual control group. Given that previous research examined language specific effects in women (Scharff, 2000; Mennen, 2007; Mennen et al., 2007), this effect was again expected to be more clear in women than in men.

As was the case in the pitch level analysis, testing whether there was a significant difference between the pitch span in the experimental and control groups was conducted separately for males and females. The reasoning behind this decision was not as apparent as it seems, given that pitch span was measured in semitones. However, as will be revealed shortly, language specific trends in pitch span opposed one another in women and men.

The non-parametric Kruskal-Wallis test was again chosen for this analysis because normal distributions in the small groups could not be assumed. On the other hand, homogeneity of variance, as indicated by Levene's test, was not violated in the pitch span analysis, as it had been for pitch level. More specifically, the Kruskal-Wallis tests examined the following hypotheses across groups:

- Hypothesis 1b (the German monolingual control group will have a significantly more narrow pitch span than the English monolingual control group); and
- Hypothesis 2b (the German bilingual migrants will have a significantly wider pitch span than the German monolingual control group).

The Wilcoxon signed-rank test again investigated:

- Hypothesis 3a (pitch span will be the same in both of the bilinguals' languages).

From Table 6.2, it appears that the female control participants patterned as expected. This is to say that the pitch span of the German monolingual females was on average more narrow than the pitch span of the English monolingual females. In the former group, for example, an 80% Range of 8.07 ST was observed, whereas in the latter group, the same dependent variable was 9.78 ST. This tendency was also observed in the other two pitch span measurements of IQR and SD4 for the female control participants. As was observed in the analysis of pitch level, the pitch span of the bilingual females was on average intermediate to that of the monolingual females. For example, the 80% Range of the bilingual females in German was an average of 9.20 ST, and in their English it was 9.64 ST. The dependent variables of IQR and SD4 were also on average intermediate in the bilingual females.

However, none of the observed differences proved to be significant. More specifically, for 80% Range, $H(2) = .45$, $p = .80$; for IQR, $H(2) = .71$, $p = .69$; and for SD4, $H(2) = 1.25$, $p = .53$. This meant that with regard to pitch span, although language specific tendencies were suggested by the averaged dependent variables, neither Hypothesis 1b nor 2b could be verified for the females.

The Wilcoxon signed-rank test, which tested Hypothesis 3b, was also not significant regarding the comparison of the dependent variables of pitch span across the languages of the bilingual females; for 80% Range, $z = -1.01$, $p = .38$; for IQR, $z = -.21$, $p = .91$; and for SD4, $z = -1.52$, $p = .16$ (see footnote on page 185). This lack of significance could again not be attributed to merging effects between the languages of the bilinguals because the control groups did not differ. Instead, it is more likely that the lack of significance was a result of speaker specificity.

			80% Range (ST)	IQR (ST)	SD4 (ST)
German Monolinguals	Females	Mean	8.07	4.61	16.38
		Stdev	1.67	1.25	3.79
	Males	Mean	9.03	4.73	15.12
		Stdev	0.85	0.47	2.03
Bilinguals in German	Females	Mean	9.20	4.80	16.46
		Stdev	2.74	1.78	4.94
	Males	Mean	10.83	6.03	18.29
		Stdev	2.18	1.72	4.30
Bilinguals in English	Females	Mean	9.64	4.93	17.90
		Stdev	2.54	1.57	4.69
	Males	Mean	10.67	5.90	18.89
		Stdev	0.96	0.90	3.67
English Monolinguals	Females	Mean	9.78	5.25	20.94
		Stdev	3.80	2.97	11.19
	Males	Mean	7.62	4.00	11.63
		Stdev	1.10	0.35	0.70

Table 6.2: Pitch span of bilingual migrants and control groups. 80% Range, IQR and SD4, as well as standard deviation (Stdev) are displayed in semintones.

Surprisingly, in Table 6.2 a wider pitch span on the part of the German males than on the part of the English males is reported. In fact, the German male controls had a wider pitch span than the German *female* controls. For example, 80% Range was 9.03 ST for the German males, compared with 8.07 ST for the German females. In contrast, the English female controls displayed a rather wider pitch span than the English male controls in all pitch span measurements (for the dependent variable of SD4, the English female pitch span was almost double as wide as the male pitch span, respectively 20.94 ST versus 11.63 ST). The difference between pitch span was indeed less between the German sexes

than it was between the English sexes. Moreover, in general, the bilingual males had an even wider pitch span than did the German male controls. In fact, the bilingual males' pitch span was wider in *both* of their languages than the bilingual females. For example, 80% Range in the German of the bilingual males was 10.83 ST whereas in English it was 10.67 ST. In contrast to the women, the Kruskal-Wallis tests for the men were significant (for the dependent variable of 80% Range, $H(2) = 5.85$, $p < .05$; for IQR, $H(2) = 5.85$, $p < .05$; and for SD4, $H(2) = 5.96$, $p < .05$).

These results were followed up on by conducting two Mann-Whitney tests. Test 1 investigated differences in 80% Range between the control groups (Hypothesis 1b) and Test 2 investigated differences in 80% Range between the German of the bilingual migrants and the German control group (Hypothesis 2b). It was considered redundant to test all three dependent variables of pitch span because IQR and SD4 had patterned the same as 80% Range. Incorporating the Bonferroni correction (at a .025 level of significance) meant that the results of Test 1 were not significant, $U = 0.0$, $p = .046$. Test 2 was also not significant, $U = 2.5$, $p = .37$. Given that the male groups were quite small, it is suggested that in larger samples, there may have indeed been a significant difference between 80% Range in the monolingual control groups, with the pitch span of the German control group being wider than the pitch span of the English control group in male participants. However, no attritional effect could be reported in the German of the late consecutive bilingual migrants.

The Wilcoxon signed-rank test, which tested Hypothesis 3b, was not significant for the comparison of pitch span across the languages of the bilingual males: for 80% Range, $z = 0.0$, $p = 1.00$; for IQR, $z = -.27$, $p = 1.00$; and for SD4, $z = -.54$, $p = .75$ (see footnote on page 185). This lack of significance could again not be attributed to merging effects between the languages of the bilinguals because, on the one hand, the control groups did not significantly differ from one another, and, on the other, because the bilingual males had on average a wider pitch span than both monolingual male groups. Instead, it is again more likely that the lack of significance between the L1 and the L2 of the bilingual males was a result of speaker specificity.

It should be emphasised that the trends in the control males were the opposite to those originally hypothesised and that the male bilinguals had a wider pitch span than *both* control groups. Nevertheless, given that the results were, in fact, not significant, the inferential analysis did not allow for Hypothesis 1b and Hypothesis 2b to be verified. In other words, it is quite possible that speaker specific determinants played a greater role in determining pitch span than did any possible language specific differences.

6.3.3 Bilingual variation in pitch range

The previous analysis of pitch range examined group trends and did not differentiate between individuals. Presently, variation in pitch range within the bilingual migrants is the focus. Interpersonal variation in pitch level is looked at before variation in pitch span.

Variation in pitch level

More specifically, further examination of pitch level was directed towards variation in the bilingual group. The question was whether some bilinguals may have more clearly displayed language specific tendencies in either or both of their languages. (I maintain that although language specific differences were not revealed in the analyses of the present study, previous research (Scharff, 2000; Mennen, 2007; Mennen et al., 2007), as discussed in Section 6.1, warranted this investigation.) More specifically, the aim was to investigate variation in the bilinguals through:

- Hypothesis 3a (pitch level will be the same in both of the bilinguals' languages).

Given that previous studies have reported age effects regarding pitch level, variation in the bilingual group was also examined in relation to age at recording. This information is displayed in Table 6.3 for both languages of the bilingual participants.

Bilingual Participant	Sex	AAR	Mean F0 (Hz)		Median F0 (Hz)	
			German	English	German	English
1ExBG	M	72	148.30	140.90	139.1	129.7
2ExCL	F	41	202.00	206.60	196.9	202.6
3ExDZ	M	79	174.20	170.20	169.7	168.9
4ExFS	M	73	122.40	129.00	118.3	126.5
5ExGB	F	61	168.70	164.20	162.3	156.2
6ExIKH	F	47	220.90	219.70	211.3	205.5
7ExID	F	69	166.00	168.80	163	165.2
8ExMZ	F	80	194.30	211.20	183.5	198.6
9ExMB	F	61	196.50	195.00	196.7	192.2
10ExRMW	F	63	202.40	190.90	199.6	185.8

Table 6.3: Pitch level, AAR (Age at recording) and sex of bilingual participants.

Most female participants displayed a similar pitch level in their German and in their English. Of the female participants, only 8ExMZ, who had an AAR of 80 years, had a noticeably higher pitch level in her English (around 211 Hz) than in her German (around 194 Hz) and participant 2ExCL slightly increased her pitch level from German to English from respectively 202 Hz to just under 207 Hz. To a certain extent, these two participants therefore contradicted Hypothesis 3a. Surprisingly, participant 10ExRMW's pitch

level decreased from approximately 202 Hz in German to 190 Hz in English. Participant 5ExGB also had a slightly higher mean F0 in her German (almost 169 Hz) than in her English (just over 164 Hz). Nevertheless, overall, female subjects tended to verify Hypothesis 3a that pitch level would be the same in both languages. Such a finding suggests that speaker specific differences in pitch level outweighed any potential language specific differences in the bilingual females, as put forth in the previous analysis.

The question was therefore asked whether this language *inspecific* pitch level was characteristic of the hypothesised German or of the English ‘norm’. Given that clear language specific trends in pitch level were not found in the initial testing of Hypothesis 1a, this question was in principle problematic; however, an exploration was nevertheless attempted. Interestingly, both of the youngest female participants of the bilinguals (2ExCL and 6ExIKH) displayed a relatively high pitch level in their German and English in relation to the average pitch level of German female native speakers. The former participant had a mean F0 of approximately 202 Hz in her German and just over 206 Hz in her English, the latter of approximately 221 Hz in German and 220 Hz in English. Nevertheless, the mean F0 of these younger participants was still within the German monolingual female statistical range. More specifically, the highest mean F0 of the German monolingual females was that of participant 6CGDM, whose mean F0 was just over 221 Hz (the outlier in Figure 6.1. Expectedly, participants 2ExCL and 6ExIKH had a mean F0 which was also within the English female statistical range.

In contrast, the mean F0 of the bilingual participants 5ExGB and 7ExID in both German and English were lower than the German female norm. These participants were respectively 61 and 69 years of age, and as such, their rather low pitch level may have been a result of age, rather than of language. Notably, their pitch level was also within the statistical range of the pitch level of both the German *and* English control females.

Interestingly, the pitch level for two of the bilingual males tended to decrease from German to English. For both participant 1ExBG and 3ExDZ, pitch level decreased from German to English, whereas in participant 4ExFS, pitch level was slightly lower in German than in English. The male participants whose pitch level decreased from German to English both displayed a pitch level which was higher than the German and English average. Participant 4ExFS, on the other hand, had a mean F0 similar to both control groups. These findings may reflect that an increase or a decrease from German to English was dependent upon a speaker’s overall mean F0 (this being in part anatomically determined).

Summarising, it can be generalised that for both the male and the female bilinguals, the speaker specific characteristics of pitch level seemed to be more salient than any (potential) language specific characteristics.

Variation in pitch span

Hereafter, variation within the bilingual group was examined with regard to pitch span. In particular, it was investigated whether some of the bilingual participants may have more clearly displayed the hypothesised language specific trends in either or both of their languages. Similar to the analysis of pitch level, age at time of recording was also considered due to the results from previous studies which have reported age effects regarding pitch span. The specific hypothesis which was tested was:

- Hypothesis 3b (pitch span will be the same in both of the bilinguals' languages).

From Table 6.4, it is apparent that, for the most part, bilingual females' pitch span was similar in German and English, although there was a slight tendency for pitch span to be wider in their English than in their German. For example, participant 6ExIKH had a substantially more narrow pitch span in German than in English. More specifically, with regard to 80% Range, she displayed 6.70 ST in German and 10.40 ST in English. Participant 8ExMZ also had a noticeably wider pitch span in her English than in her German and 7ExID and 9ExMB had slightly a wider pitch span in English than in German. Such small fluctuations in pitch span corresponded to the originally hypothesised language specific tendencies observed in the control groups, although participant 5ExGB had a slightly *wider* pitch span in German than English.

Nevertheless, because these fluctuations were quite small, in general Hypothesis 3b was descriptively verified for women.

Bilingual Participant	Sex	AAR	80% Range (ST)		IQR (ST)		SD4 (ST)	
			G	E	G	E	G	E
1ExBG	M	72	12.60	11.70	7.60	6.80	22.30	23.11
2ExCL	F	41	6.30	6.20	3.20	3.10	12.05	11.76
3ExDZ	M	79	11.50	10.50	6.30	5.90	18.83	17.14
4ExFS	M	73	8.40	9.80	4.20	5.00	13.75	16.43
5ExGB	F	61	11.30	10.20	5.80	5.20	20.77	19.61
6ExIKH	F	47	6.70	10.40	3.20	5.30	13.28	21.00
7ExID	F	69	5.20	5.70	2.70	2.70	9.54	12.21
8ExMZ	F	80	12.90	14.30	7.20	7.50	24.74	26.54
9ExMB	F	61	9.00	9.70	3.90	4.40	13.75	15.43
10ExRMW	F	63	8.10	7.90	3.90	3.40	15.58	15.72

Table 6.4: Pitch span in German (G) and English (E), AAR (Age at recording) and sex of bilingual participants.

Table 6.4 also reports the male bilinguals' pitch span in both of their languages. As displayed, participants 1ExBG and 3ExDZ had a slightly wider pitch span in German

than in English, whereas for participant 4ExFS the opposite was the case. Still, as was the case for the bilingual women, although small fluctuations in pitch span were observed, in general Hypothesis 3b was descriptively verified for the male bilinguals.

In sum, this is to say that for both the male and the female bilinguals, the speaker specific characteristics of pitch span seemed to out-weight any (potentially) language specific characteristics. Merging in the bilinguals' L1 and L2 is not claimed because no significant language specific differences between the control groups were reported.

6.3.4 Interpersonal variation and predictor variables

Given that no attritional effects were observed in the German of the late consecutive bilingual migrants, explaining attritional effects through an analysis of predictor variables was deemed misleading. For this reason, predictor variables were not investigated in the phonetic analysis of pitch range.

Nevertheless, it is of potential interest that participants 6ExIKH and 8ExMZ displayed somewhat clear language specific differences between their L1 and L2 which resembled the hypothesised trends. For the former participant, this was particularly the case for pitch span (see Table 6.4) and for the latter for both pitch level (see Table 6.3 and span (see Table 6.4). Interestingly, these participants also had the oldest AOA to Canada, 8ExMZ arrived at 32 and 6ExIKH at 29 years of age (although participant 5ExGB also arrived at 32 years of age).

6.3.5 Intrapersonal variation

In the previous results analysis, pitch level and pitch span were investigated on their own. Here these parameters of pitch range are explored in relation to one another. This was done for female and male participants separately. The question of whether bilinguals may have varied on just one dimension of pitch range was prompted by the findings of Mennen (2007).

A scatterplot for the female participants is displayed in Figure 6.2. Mean F0 is displayed on the y-axis and 80% Range on the x-axis. Firstly, it can in general be seen from this table that there was less variability in the pitch range of the German females than in that of the English females (although as already mentioned, with regard to pitch level, the German female 6CGDM had a relatively high mean F0). Overall, German females clustered around a mean F0 of around 180 Hz (see also Figure 6.1) and an 80% Range of below 10 ST. English control females on the other hand covered a broader portion of the scatterplot for both axes. This suggested that pitch range of females speakers may adhere

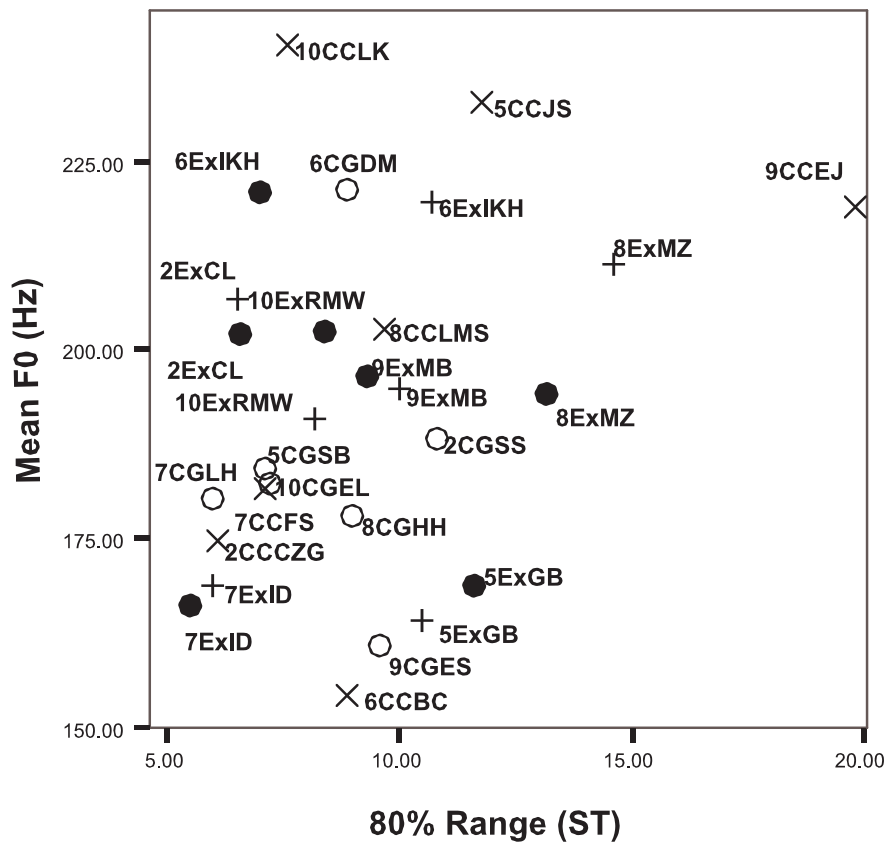


Figure 6.2: Scatterplot of mean F0 in Hz against 80% Range of females. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

to more language specific norms in German than in English. Interestingly, the bilingual females also covered a broader portion of the scatterplot, similar to the English females. This meant that the intermediate pitch level values reported on the part of the bilinguals may have been due to averaging effects, rather than a consistent group effect. Similarly, the intermediate pitch span results on the part of the bilingual females may have been a result of averaging.

The corresponding scatterplot of pitch level and span is displayed in Figure 6.3 for the male participants. Again, mean F0 is displayed on the y-axis and 80% Range on the x-axis. From this figure it appeared that there was a positive relationship between pitch level and span for men. In fact, a Pearson's correlation test indicated a highly significant relationship between mean F0 and 80% Range, $r = .76$, p (one-tailed) $< .01$. This meant that

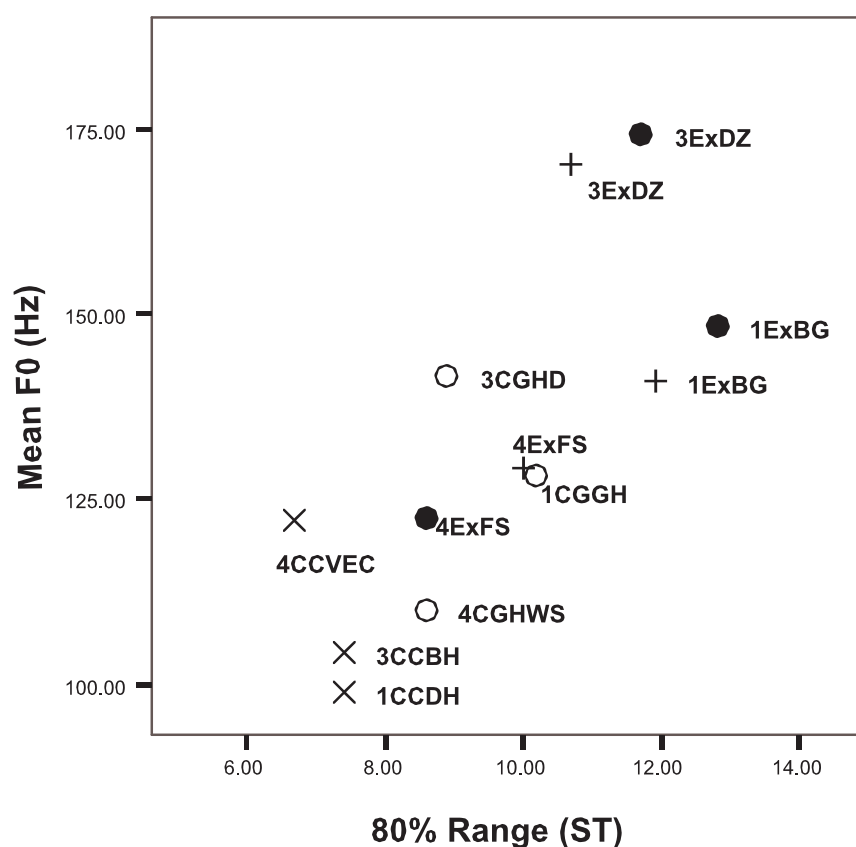


Figure 6.3: Scatterplot of mean F0 in Hz against 80% Range of males. The symbols are as follows: German Controls: ○; Bilinguals in German: ●; Bilinguals in English: +; English Controls: ×.

for men, the higher pitch level was, the wider pitch span was. As previously discussed, English monolingual males were for the most part clustered towards the lower end of both axes. This was particularly the case regarding pitch span. In contrast, German monolingual males had on average higher results for both pitch level and span (than the English monolingual males). Of the bilingual males, only participant 4ExFS patterned near to the monolingual groups. More specifically, his German was close to the German controls; however his pitch span was higher in English than in German. Participants 1ExBG and 3ExDZ were at the higher end of both axes, although in their English these latter male participants moved closer to both the English and German control groups.

6.4 Discussion of pitch range analysis

With regard to the first set of hypotheses, in terms of the female controls, the descriptive analysis suggested that pitch level was lower and pitch span more narrow for the German females than for the English females. These trends were in line with previous studies, in which similar findings were attained (Scharff, 2000; Mennen, 2007; Mennen et al., 2007). However, these descriptive findings could not be verified inferentially. Lack of significance may have been a result of the greater within group homogeneity, regarding both level and span, displayed on the part of the German female controls. As previously mentioned, less variation in pitch range on the part of German females was also observed in the study by Mennen et al. (2007). The English females of the present study, on the other hand, displayed more interpersonal variation with regard to pitch range. This is to say that, in a sense, they “used more of the scatterplot” than did the German females. In other words, it may have been that German females were more likely to adhere to *some* sort of language specific norm for pitch range - as a group - whereas English females were more likely to display more interpersonal variation with regard to pitch range. In a sense, this would mean that more extreme pitch range values are permissible on the part of English females, but not on the part of German females.

Continuing on the first set of hypotheses, for the male control participants, the descriptive analysis suggested that pitch level was on average higher and pitch span wider for the German group in comparison to the English group. However, this tendency observed in the averaged dependent variables only approached significance. To a certain extent, the findings supported the results by Scherer (1979), who found that German males generally had a higher pitch level than American English males. In fact, pitch span was wider for the German males than it was for the German females. Moreover, the difference between pitch span was less between the German sexes than it was between the English sexes.

Summarising the results for the control groups, no significant differences were observed between the German and English control groups. Interestingly, differences between the sexes regarding pitch level were greater in the English group than in the German group. Moreover, regarding pitch span, the opposite effect was observed, i.e. on average the span of the German males was wider than the pitch span of the German females, whereas on average the pitch span of the English males was more narrow than the span of the English females. This is essentially to say that, at least in the small samples of the present study, pitch range seems to be more gendered in English than in German.

Finally, specifically regarding female controls, more interpersonal variation was displayed by the English females than by the German females. Sociophonetically, this may mean that if pitch range is more gendered in English than it is in German, English women

may be, in effect, moving towards or away from an English male norm (or from one another) within their own language.

Moving on, given that the hypothesised language specific differences between the control groups were not verified, the second set of hypotheses were problematic. In terms of the female participants, it could not be established that pitch level was higher in the bilingual females than in the German females, nor that pitch span was wider in the former than in the latter group. Instead, more variation was displayed on the part of the bilingual females in comparison to the German females. This is interesting considering that English females, too, displayed more interpersonal variation with regard to pitch range than did the German control group.

If pitch range displays, in English, less of a language specific “norm” than it does in German, it could be expected that any attritional effects would display themselves in a dispersion around the German norm, rather than an overall movement to *another* norm. Where more heterogeneity is displayed (in the English monolingual females), an attritional effect in the German of the bilingual migrant females would be for these participants to display the *heterogeneity* of the L2 group, rather than to, in a sense, homogeneously move to another “norm”, which was, in fact, not particularly evident. Such speculations would however need to be verified in larger groups. Nevertheless, it is interesting to note the possibility of attritional effects displaying themselves as dispersion from an L1 norm (e.g. within group interpersonal variation) if it is this which characterises the L2.

Continuing with an interpretation of the male bilingual migrants, based on the descriptive results of the control data, the second set of hypotheses were in fact not applicable to the male bilingual migrants. This was because pitch level was on average lower, and pitch span more narrow, in the English male controls than in the German control males. However, these effects were surprisingly not evident in the German of the bilingual males. In other words, it cannot be said that bilingual males moved towards a more English-like pitch range in their German. *Instead*, pitch level was quite noticeably higher, and pitch span wider in two of the bilingual males than in both the German and English controls. This finding deserves more attention.

If pitch range is more gendered in English than it is in German, as is suggested above, these surprising results on the part of the German bilingual males may be an indication of these particular participants not adhering to the more gender specific norms of the English language. As such, German migrant males in Canada may be picking up on the wider pitch span of the English *females*, and interpreting these as language specific norms, whereas they may, in fact, be gendered language specific norms. Quite simply put, this would mean that they may be picking up on the “wrong” gender norm of English, but understandably, on the salient differences between the English and German languages.

Such an interpretation again emphasises within language interpersonal variation, and here its effects on both L1 attrition and L2 acquisition.

Finally, given that the first set of hypotheses were not significant, it was again problematic to interpret the third set of hypotheses. Overall, pitch level was generally the same in both of the bilinguals' languages. This means that speaker specificity for both the male and the female participants was a more clear trend than language specificity, as given that no significant language specific differences were reported, "merging" could not have been an explanation. These findings support the overall results from the testing of the first set of hypotheses which suggested that speaker specificity may have outweighed any potential language specific differences in the pitch range of German and English control groups. Only participant 8ExMZ displayed relatively clear language specific trends in her L1 and L2 with regard to both pitch level and pitch span. For participant 6ExIKH there was a noticeable widening of pitch span from German to English. Interestingly, participants 8ExMZ and 6ExIKH also had a relatively late AOA to Canada in comparison to the other late consecutive bilingual migrants. Still, on the whole, pitch range was similar for the female bilinguals in both of their languages; however, there was more overall interpersonal variation in their pitch range results than in that of the German female controls. This may, again, suggest that attritional effects display themselves in dispersion from an L1 norm, given that more heterogeneity was evident in the English monolingual females than in the German monolingual females.

In summary, these findings are inconclusive, yet they raise interesting questions with regard to potentially language and gender specific differences in pitch range, as well as their effects on first language attrition.

Chapter 7

Discussion

It is the objective of the present chapter to bring together the results from both Experiment I and Experiment II. A general overview of the findings from each experiment are reported and the sociolinguistic and theoretical consequences of the research are debated.

Subsequently, the limitations of the present research are considered and suggestions for future studies are presented.

7.1 Reassessing native speech

Foremost, the findings from both experiments force one to question the concept of native speech. Approximately one quarter of the 57 late consecutive bilingual migrants in Experiment I were perceived to be non-native speakers of their native German language by monolingual German listeners. These bilinguals had moved to either Anglophone Canada or the Dutch Netherlands as adults after having fully acquired their native language. Yet on the basis of foreign accented native speech, they were judged to be non-native speakers of German. At least according to the definition of the present thesis, they *were* native speakers of German. This conflict of definition highlights the ambiguity of the term “native speech”, and in a broader sense, likewise the term “native speaker”.

In the case of L2 acquisition, Hyltenstam and Abrahamsson describe “non-perceivable non-nativeness” (2003 : p. 572), more specifically with regard to ultimate L2 attainment. Hyltenstam and Abrahamsson’s argument follows the logic that it is possible for non-native speech to go unnoticed by native speakers, but that there is methodology (presumably acoustic analyses, articulatory techniques such as ultrasound and electropalatography, as well as brain imaging methods such as fMRI) which allows for the detection of (what is actually) non-native speech. This means that a person may be perceived as belonging to the in-group language community when, in fact, fine phonetic analyses,

amongst other methodology, may reveal that they are not. Note however that such phonetic analyses only obtain information regarding the performance of the speaker. What the speaker remains capable of, or the underlying competence, is not assessed by such phonetic analyses. Indeed, Hyltenstam and Abrahamsson's differentiation stresses the discrepancy between perception of native speaker status, and actual native speaker performance. For Hyltenstam and Abrahamsson (2003), it is the latter which determines whether one is really a native speaker.

If this line of thought is related to the present study, and hence L1 attrition instead of L2 acquisition, it is feasible that a speaker, who is *perceived* to be a non-native speaker (as was the case for 14 bilinguals in this experiment), is actually the mirror situation, which would be (according to the argument of "non-perceivable non-nativeness") a "non-perceivable native speaker". As such, although the late consecutive bilingual migrants were assessed to be non-native speakers of their German, their L1 may in fact have been stored in much the same way (at the level of competence) as the L1 of the monolingual German non-migrants. The speculation is that although the perception of native speaker status differed between some of the bilinguals and the control group, the underlying competence may not have. Fundamentally, however, the performance level of the 14 late consecutive bilinguals must have differed from the control group in order for the former to be perceived as non-native speakers of German.

In fact, this is a contradiction in argument: if in the ultimately attained L2, deviations from a monolingual native speaker norm at the level of performance suffice in disqualifying an advanced L2 learner from native speaker status, should the same not hold true in the case of the 14 bilinguals in Experiment I? It is the competence argument which is brought forth in the case of these late consecutive bilinguals, somehow maintaining their (non-perceivable) native speaker status in German. The assumption is that although at the performance level advanced L2 learners and late consecutive bilinguals who display foreign accented native speech may seem quite similar, their underlying competence differentiates them. However, without determining what constitutes competence, this assumption may be premature. Moreover, if deviation from the monolingual norm is not sufficient in disqualifying the present 14 late consecutive bilinguals from native speaker status, should it not, likewise, be insufficient in disqualifying advanced L2 learners from native speaker status? It seems that if the competence argument is applied to native language loss, it must similarly be adopted with regard to ultimate L2 attainment. Or, at the very least, the performance argument alone is insufficient in disqualifying advanced L2 learners from native speaker status.

The ambiguity of what it means to be a native speaker is also brought to light when one examines the idea of there being a "norm". Generally, native speaker status is based

around a rather exclusive definition of a monolingual norm (Cook, 2003). There is an unspoken assumption that goes along with statements like “non-perceivable non-native speakers” which is that monolingualism defines native speaker status, and hence the norm. Practically, this means that the control group, to which the advanced L2 learners are compared, comprises monolinguals (and, because these are not always easy to find, a strict definition may be wavered, which in itself highlights that monolingualism is actually not the norm). Nevertheless, is this line of thought justified - do monolinguals represent the native speaker norm? Instrumental investigations suggest that the L1 and L2 phonetic systems of simultaneous or early bilinguals influence one another (Watson, 1990; Khattab, 2000; Gordeeva, 2006), and that this interactional effect is revealed in adulthood (Caramazza et al., 1973; Sundara et al., 2006). Such individuals, who acquired more than one language from childhood onwards, may diverge from a monolingual native speaker norm in adulthood; but they too would nevertheless be considered to be native speakers - or not? If not, the consequence would be that they have no native language, which seems rather unlikely. As simultaneous bilinguals, they presumably have two native languages, which perhaps differ from monolingual native speakers, but fail to disqualify them from native speaker status at all. If the notion of native speaker is widened at the level of performance to include *multilingual* native speakers, who, too, diverge from a *monolingual* native speaker norm, the same diversions on the part of other *consecutive* bilinguals in their L2 could no longer violate, or classify as diverging, from a native speaker norm. Moreover, if the late consecutive bilingual migrants of Experiment I are still deemed native speakers of German, regardless of phonetic deviations in their L1 from a monolingual German norm (perceived as foreign accent), these same, or similar, deviations must not enable disqualification from native speaker status in L2 speakers of German.

The significance of this argument relates not only to the perception of foreign accented native speech, but also to speech production, explored through fine phonetic analyses. In Experiment II, monolingual native speaker norms were evident in the control groups. More specifically, the frequency of F1 in the lateral phoneme /l/ of the Germans was significantly lower, and the frequency of F2 significantly higher, than of the Anglophone Canadians. In terms of the lateral phoneme /l/, there appeared to be little overlapping of the realisations in the German and English monolinguals. Within the prosody of the control groups, both the start and the end of the prenuclear rise occurred significantly earlier in the English monolinguals than in the German monolinguals, although more overlapping was displayed in this prosodic element. Nevertheless, such findings coincide with the notion that there are monolingual native speaker norms (here more clear in the lateral phoneme /l/ than in alignment of the prenuclear rise), detected at the level of performance, and that such phonetic differences serve to differentiate languages.

The question was therefore whether the late consecutive bilingual migrants deviated from these monolingual norms in their native speech. In the production analyses it was revealed that, as a group, the bilingual migrants had a higher F1 frequency and an earlier alignment of the prenuclear rise in their native German speech than did the monolingual German control group. Such deviances from the German control group, may, or may not, be perceived by native German listeners. Nevertheless, they indicate that at the level of performance, the bilingual migrants no longer conformed to the German monolingual norm. In the context of this thesis, this is to say that, as a group, the bilinguals underwent attrition in the domain of phonetics. Crucially, it is questionable whether these deviations disentitle the bilinguals from native speaker status - in their native language. I maintain that despite these deviations, the German migrants to Canada are still native German speakers. In the same right, this means that similar, or perhaps even the same, deviations cannot be interpreted as evidence for disentanglement of native speaker status in an L2. More information regarding competence must be gathered - for both the L1 and the L2 speakers - if it is this which ultimately defines native speaker status.

Summarising, the findings from these experiments perhaps make the term “native speech” more ambiguous than it was before the investigation. If native speakers (defined as such given that they learned their L1 from childhood onwards) diverge from a monolingual native speaker norm, but still ideologically *maintain* their native speaker status (and I advocate this here), it must be possible for L2 speakers to similarly diverge from a monolingual native speaker norm in their L2, but nevertheless *attain* native speaker status.

7.2 What was lost?

In commencing this section, the term “loss” is initially reassessed. There is no negative judgement in the (or, perhaps more specifically, my) definition of loss, be it based on perception, performance, or, much less likely, competence. Observing that something occurs, as the profession of researchers dictates, does not imply judgement. To the contrary, observation may lead to more acceptance of an arguably growing phenomenon. Moreover, a clear description of the direction of change (aka that which was once there is no longer there) makes the term “loss” tangible for non-linguists.

In fact, suggesting that the term “loss” implies value judgement may insinuate that loss is somehow perceived as negative. Is there any basis on which one can assume this? I argue that many migrants may perceive losing aspects of their L1 as a thoroughly positive experience, just as many migrants may perceive loss as detrimental. There is no inherent superiority associated with L1 maintenance, nor with bilingualism as such - just as there

is no inherent superiority associated with monolingualism. To assume that all migrants somehow mourn losing aspects of their L1 falsely justifies that for this reason the direction of change should be couched in less specific terminology.

Perhaps a slight deviation exemplifies my argument. At the end of a presentation by Peter Ladefoged on his documentation and recordings of endangered languages (which I was very fortunate to attend at the University of Edinburgh in the autumn of 2005 before Professor Ladefoged passed away on January 24, 2006) a member of the audience stood up and praised Professor Ladefoged for encouraging the maintenance and proliferation of endangered languages. It was a well-meaning comment, yet Professor Ladefoged replied that he actually did nothing of the sort. Summarising his response, he discouraged the false assumption that people who speak an endangered language always want to maintain their language. This is often not the case. For various reasons, which extend far beyond the topic of this thesis, speakers of endangered languages may see no reason in maintaining their language and in fact discourage maintenance. According to Professor Ladefoged, his vast documentation merely gives speakers of endangered languages the opportunity to preserve their language, if they so desire. Of course, there are speakers of endangered languages who want to maintain their language, which should without a doubt be supported, but it cannot be assumed that the loss of language is always grieved. In my view, his comments illustrate that bilinguals *may* indeed perceive losing a language as positive. Therefore, it is possible to turn the criticism of the term “loss” around, as such terminology is in fact a positive judgement given that some bilinguals may desire losing their language. Naturally, this line of thought, that “loss” implies a positive value judgement, is absurd; but, similarly, so is the claim that the word implies a negative value judgement. Instead, “loss” solely conveys, tangibly to non-linguists, the direction of the change. Recapitulating, I do not pass judgement when using the term “loss”, as I do not assume an inherent superiority in either the maintenance or loss of any language, as such.

Continuing with the present question - what was lost? - as discussed in the previous section, Experiment I revealed that, on the basis of foreign accent, native speaker status was lost, at least at the perceptual level, for 14 of the bilingual migrants. This, in itself, is a major indication of first language attrition in the domain of phonetics. Nevertheless, the other late consecutive bilinguals were either perceived to be native speakers of German, or their assessment was unclear. If one accepts Hyltenstam and Abrahamsson’s (2003) claim that it is possible for deviations from a native speaker norm at the level of performance to go unnoticed, it may very likely be the case that not all deviations in the bilingual speakers of Experiment I were perceived by the listeners. This was essentially the focus of Experiment II, in which diversions from a monolingual norm were investigated in speech production through fine phonetic analyses.

The findings from the group analyses of Experiment II revealed that in the German of the late consecutive bilinguals, the F1 frequency of the lateral phoneme /l/ was significantly higher, and the alignment of the start of the prenuclear rise significantly earlier, than in the German control group. These results indicated that segmental and prosodic aspects of the late consecutive bilinguals' native speech were lost in the L2 migrant setting. Alternatively, the F2 frequency of the lateral phoneme /l/ in the late consecutive bilinguals was in most cases not significantly different from that of the German control group, nor was the alignment of the end of the prenuclear rise in these two groups. It appeared that, in the group analyses, a single dimension within each phonetic element underwent first language attrition, whereas the other did not.

In linking production to perception, the question arises whether *all* that deviated from the monolingual native speaker norm within production (as revealed in the phonetic analyses), was, or is, actually perceived as such. In fact, there is strong evidence which suggests that an individual's perception is determined to a certain degree by the input of his or her environment. Although the perceptual magnetic effect was specifically detected in the acquisition of native (monolingual) speech, it has been linked to L2 acquisition. As described in Chapter 1, an aspect of Kuhl's (1993, 2004) research postulates that native (monolingual) speakers develop mental representations from the information they hear. Crucially, the same acoustic representations may be categorised differently dependent upon the prototypes established in different native (monolingual) backgrounds. In other words, there is a perceptual space around a prototype in which realisations similar to the prototype, but not identical, are perceived as belonging to the prototype. Relating this research to the results of the present study, if the prototypes of language A (German) and language B (English) are situated close to one another in this phonetic space, the listener of each language will perceive the same acoustic representation as being within the phonetic space of respectively *either* language A or language B. This information suggests the possibility that not *all* deviations in production from the monolingual German norm were likewise perceived as such, and, in a way, lend support to the notion of "non-perceivable non-nativeness".

Obviously, the 14 late consecutive bilingual speakers who were assessed as non-native German speakers in Experiment I produced aspects of their German speech which were outside of this "magnetic space". But I explicitly argue that other, potentially less salient deviations from a monolingual norm, revealed through the fine phonetic analyses in Experiment II, do not *per se* de-qualify the bilingual migrant from native speaker status, as defined by a monolingual norm. This is because perception and production differ from one another. Instrumental studies may pick up on differences at the level of performance between a monolingual native speaker norm and a bilingual experimental group, but these

are not equivalent to the differences actually perceived. Accordingly, instead of debating along the lines of “non-perceivable non-nativeness”, one can emphasise that if so detected the speech in question is different in production from monolingual native production, but it is a secondary investigation which determines whether this is perceived in the perceptual spectrum of native speech. Native speech, as such, comprises the dimensions of *human* production and perception. Being a native speaker depends on both halves of the communication chain - on the speaker as well as on the listener. Production deviances from a monolingual norm do not disentitle the consecutive bilingual migrants of this study from native speaker status in their L1 because they do not incorporate the other half of the communication chain. This argument similarly applies to ultimate L2 attainment: advanced L2 learners who *approach* monolingual norms at the level of production and *achieve* them at the level of perception *are* native speakers.

Note that this argument differs from the former of the previous section based on competence (if deviations from a monolingual norm at the level of performance do not disqualify speakers from native speaker status in their L1, they similarly cannot disqualify speakers from native speaker status in their L2). The presently discussed perception argument focuses on the actual perception of the performance on the part of the listener. In other words, it is essential to assess what the listener perceives, when conversing about nativeness, as it is the *human* perceptual system which perceives and determines native versus non-native speech.

Recapping, the crux of this perception argument is the perceptual magnet effect (Kuhl, 1993; 2004) - what is different at the level of production is not necessarily different at the level of perception. Essentially, this phenomenon indicates an internal flexibility in the perception of norms on the part of the listener, who are, again, in most cases monolinguals. It is however conceivable that external input also determines the perceptual magnetic effect, or how much flexibility is allowed, for want of a better word. Perhaps children growing up bilingually display more flexibility in their prototypes (Watson, 1990; Khattab, 2000; Gordeeva, 2006; Sundara et al., 2006), which impacts how they perceive deviations from a monolingual native speaker norm (Caramazza et al., 1973). Perhaps languages with numerous dialects also allow for more flexibility in what is perceived by the listener as foreign accented?

Bongaerts et al. (1997) found that some late consecutive non-native speakers of English were more consistently assessed to have non-foreign accented English than the control participants, who were all “real” native speakers of English. The speculation was that this might have been because the control group was more likely - than the bilinguals - to produce regionally accented speech. In other words, the listeners may have been more likely to categorise regionally accented speech as foreign accented than non-regionally

accented speech. The point is that perceptually there may be a grey area, in which the listener is not working within a yes-no framework. This is not to say that assessing someone to be a non-native speaker, or native speaker, whatever half of the glass one is interested in, does not at one point, take place categorically.

The role of perceptual flexibility in determining what constitutes native speech was potentially demonstrated in Experiment I. Here no particular L2 group was more likely to be perceived to be non-native speakers of German than the other. Some German listeners in fact responded that they had difficulties differentiating between regionally accented and foreign accented speech (in particular regarding speakers from Northern Germany). It appeared that the more similar the language varieties were - for the listener - the more difficult it was to tell them apart. Conceivably, although the Dutch L2 speakers may have had a stronger foreign accent in their native German speech, the German monolingual listeners were just unable to perceive this foreign accent due to Dutch and German being *similar*. Such flexibility in the ear of the listener is crucial to a definition of native speech because both halves of the chain, the listener and the speaker, determine native speech.

In terms of Experiment II, the group analyses indicated that in the German of the late consecutive bilinguals, the F1 frequency of the lateral phoneme /l/ was significantly higher, and the alignment of the start of the prenuclear rise significantly earlier, than that of the monolingual German control group. But whether these differences were perceived as non-native is another question, because the perceptual magnetic effect influences how non-prototypes are perceived. In the group analyses, the late consecutive bilingual migrants had distinct variants of the lateral phoneme /l/. Although the frequency of F1 in the German /l/ approached that of the English /l/, differences were maintained in each of the late consecutive bilinguals' languages. In contrast, the group analyses of prosody revealed that merging was evidenced for the alignment of the beginning, but not of the end, of the prenuclear rise in the bilingual migrants. However, given that the monolingual prosodic norms of German and English were close together, it really is arguable whether such interactional effects would be perceived by listeners as non-standard. Either way, even if deviations from a monolingual norm in speech production are perceived as non-standard (which a follow-up study would need to determine), I maintain that this simply broadens the definition of what native speech is. Nevertheless, if it is accepted that the late consecutive bilinguals of this study at one point adhered to the norm of the monolingual control group, and now no longer do (at the performance level of speech production), first language attrition is assumed to have occurred.

In sum, at the perceptual, segmental, and prosodic levels of speech, first language attrition was evidenced - but none of these constitute reason for disentanglement of native speaker status.

7.2.1 Sociolinguistic consequences

The above discussion argues for a more inclusive definition of native speaker. Alternatively, if one contends that it is truly an underlying competence which distinguishes native speaker status from non-native speaker status, the consequences of this must be discussed. Firstly, the question becomes: what is competence? Or, how does one define and measure competence? I have approached this issue in Chapter 1 (page 11 and thereafter) and do not repeat the discussion around the complications associated with answering these (Turing-like) questions here. Briefly, there is a black box element to competence, which make its definition and assessment problematic. Of course, not being able to practically measure competence does not mean that it does not exist; it does, however, suggest lack of falsifiability.

Assuming that it is, in fact, an underlying competence which defines native speaker status, the ramifications of this assertion on the present research are worth discussing. In my view, there are foremostly sociolinguistic consequences. If loss in the L1 is considered to only be verifiable at the level of competence, where does this leave the experiences of the bilingual migrant? Moments of interaction with fellow migrants and native speakers, which this investigation is assumed to be in part reflective of, presumably impact a migrant's perception of him or herself, as well as the interlocuter's perception of the migrant. Through confining the definition of first language attrition to what is revealed at the level of competence, researchers may overlook the emotional and sociolinguistic reality of language loss for migrants, who, according to the United Nations, are becoming a larger portion of the world's population.

The sociolinguistic consequences of loss, at what is at the very least the level of performance, are far-reaching. The leading of these has to do with identity and cultural affiliation. It stands to reason that the bilingual migrants of Experiment I, who were perceived to be non-native speakers of their native language based on foreign accented native speech, were likewise no longer considered to be members of their native German language *community*. No longer being incontestably perceived as a member of the original language community may have direct consequences on how, for example, acquaintances, friends, or even family members in the country of origin interact with the bilingual migrant. The change in perception may also impact how the migrant situates him or herself in relation to both the country of origin and the recipient country. How are visits to the country of origin experienced by the migrant? How do other, perhaps newer, migrants in the recipient country interact with those who no longer fulfil native speaker status? To which language community do such speakers *belong*, in the case that they are potentially

not considered to be native speakers of either of their languages?¹

These questions move past a relatively theoretical discussion of competence, performance and perception. Instead, they revolve around the identity of the bilingual who no longer conforms to what may be a native speaker ideal, or even an illusion. Moreover, the questions centre around a perhaps more traditional two dimensional view of culture (*either* that of the L1 *or* that of the L2), whilst it may be a third, or even higher dimension, arising within the bilingual community, to which affiliation is greatest (Kramsch, 1993). Such sociolinguistic consequences focus on the active role of the individual who forms his or her environment, in addition to being formed by it (Brandtstädter, 1993; de Bot, 2007).

Opening this door, and questioning what it personally, or emotionally, means for the bilingual migrant to undergo, or potentially even initiate, native language loss, is of consequence for a growing number of migrants worldwide.

7.3 In terms of the SLM

The previous sections summarised the results of Experiment I and II with regard to the notion of native speech, as it exists within the realms of perception, performance and competence. Presently, the impact of the findings in terms of the Speech Learning Model, or SLM (see Section 1.3.2) are debated.

The SLM does not really offer an explanation of the present results which indicated differences in the attrition of more than one dimension within a single phonetic element. The previous studies discussed in this thesis, which investigated either directly or indirectly first language attrition in the domain of phonetics at the segmental level, focused on a single parameter of a sound (Flege, 1987; Flege and Hillenbrand, 1984; Major, 1992; Sancier and Fowler 1997). The present study brings new information because two acoustic correlates were investigated within each phonetic element. If place of constriction is associated with F2 frequency, and openness, or pre-dorsum lowering with F1 frequency, it appears that lack of pharyngeal constriction was maintained more often than not in the late consecutive bilingual migrants. It was this articulatory characteristic which the bilinguals were less likely to acquire in their L2, and more likely to maintain in their L1. Moreover, the articulatory dimension of openness was more likely to be acquired by the late consecutive bilingual migrants in their English, and more likely to undergo attrition.

¹Conceivably, there are indeed other settings in which a second language gains in dominance, although migration to a new country does not occur. For example, in the case of colonialism, a second language has often replaced a native language although no migration occurs in the group acquiring the L2. Potentially, there are similar sociolinguistic consequences regarding cultural affiliation in such settings.

The complexities of similarity are highlighted by this case - what dimension is used as the criterion for determining similarity? Moreover, is either one of these dimensions more salient at the level of perception than the other? Such questions may provide information as to why intrapersonal variation regarding first language attrition occurred in this segmental variable.

In terms of the Speech Learning Model (SLM), similar sounds in an L1 and an L2 are more likely to merge, whereas sounds which are not similar are more likely to maintain their separate categories. “By hypothesis, category formation will be blocked if instances of an L2 speech category continue to be identified as instances of an L1 category. The SLM predicts that in such cases, a “merged” category will develop over time that subsumes the phonetic properties of the perceptually linked L1 and L2 speech sounds” (Flege et al., 2003 : p. 469). In the group analyses of the lateral phoneme /l/, it appeared that the phonetic dimensions of this segment significantly differed in the bilinguals’ German and English. In terms of prosody, bilingual migrants were more likely to maintain, or achieve, language specific realisation of the alignment of the end of the prenuclear rise, but not of the beginning. Although these findings are of interest, they do not test the validity of the SLM, given that only segmental aspects of speech are incorporated into this model.

When merging was investigated in individual participants, rather than in a group analysis, only two participants evidenced a merged lateral phoneme /l/ in their German and English. Interestingly, these were within different monolingual language specific norms. One participant produced equivalent lateral phonemes which were within the English norm, and the other within the German norm. On the other hand, merging at the level of prosody appeared to be more common in the individual analyses. Six participants performed similarly regarding the alignment of the prenuclear rise in German and English, and two of these displayed a merged prenuclear rising accent in German and English which was within the English monolingual norm. Only one speaker evidenced merging which amounted to the production of both the lateral phoneme /l/ and prenuclear tonal alignment in German which corresponded to the English monolingual norm. Nevertheless, because the SLM does not make predictions for prosody, it is difficult to interpret the present results according to this model.

Still, the findings highlight the high degree of variability across participants. Although first language attrition was revealed in both Experiment I and Experiment II, interpersonal variation showed that not all participants performed similarly. Eight individuals evidenced first language attrition in the F1 frequency of the lateral phoneme /l/, whereas only two of these also evidenced first language attrition in the F2 frequency of the same segment. In contrast, two speakers did not reveal first language attrition in either of the dimensions which characterised the lateral phoneme /l/. In terms of alignment of the prenuclear tonal

rise, five participants were considered to evidence first language attrition in the start of the rise, but given that the alignment of the end of the rise was more similar in the monolingual control groups, an assessment of first language attrition at an individual level was considered unreliable.

One participant maintained the German monolingual norm in the alignment of her prenuclear tonal rise, but evidenced first language attrition in both dimensions of the lateral phoneme /l/. Alternatively, no participant revealed first language attrition in prosody who did not also do so in the lateral phoneme /l/. Nevertheless, it is premature to assume that prosody is more likely to undergo first language attrition, as the frequency of F2 appeared to be the most stable acoustic correlate in the production analysis. If anything, the results support a multidimensional approach in fine phonetic analyses of bilingual speech (Sundara et al., 2006).

This relatively high degree of interpersonal and intrapersonal variation is difficult to incorporate into the SLM.

7.4 Why was it lost?

A further aspect of this study investigated the impact of predictor variables on first language attrition in the domain of phonetics. In both Experiment I and II, age of arrival were significant predictor variables. Migrants who moved abroad at an earlier age were more likely be perceived as having a foreign accent in their native language and deviate from a monolingual native language norm than those who moved abroad at a later age. Moreover, the alignment of the prenuclear rise was more likely to occur earlier, and be more English-like, in migrants who moved to Canada at a younger age than in those who moved at an older age. Accordingly, it therefore appeared that the general prediction of the SLM, that “the phonetic categories used to produce and perceive the phonetic segments distinguishing L1 words are hypothesized to become more powerful attractors of L2 vowels and consonants as they develop through childhood and into adulthood” (Flege et al., 2003 : p. 469) held true for the present study as well.

However, it would be premature to assume that age of arrival is the only predictor variable of consequence in determining first language attrition in the late consecutive bilinguals of the present study, especially considering the multicomponential nature of age (see page 37 and thereafter). Nonetheless, the fact that age of arrival also strongly correlates with L2 acquisition, and how this in turn impacts first language attrition, is a continued line of research which may wish to be taken up. However, the fundamental question for studies in first language attrition remains whether “the errors in a half-forgotten language

have a logic of their own too ... and are not simple interference phenomena” (Dorion, 1982 : p. 57).

7.4.1 Language contact and L1 attrition

A variable which was deemed of importance in predicting first language attrition in the domain of phonetics was that of contact. The findings from Experiment I suggested more first language attrition occurred in those speakers who had less contact with their L1, whereas less first language attrition occurred in those who had more contact with German. Moreover, the results indicated that it was not only the amount of contact, but potentially also the type of contact which influenced first language attrition. Contact characterised by settings in which a small amount of code-switching was predicted, potentially conducive of a monolingual mode, decreased, or inhibited, an attritional effect. Contact which was characterised by language mixing, potentially conducive of a bilingual mode, on the other hand, had no effect on the process of L1 attrition in Experiment I. To a certain degree, these results lend support to the Subsystem Hypothesis (see Section 1.3.1), in that more contact with the German L1 may have lowered the activation threshold for their L1.

The issue of quantifying language contact in the present study, and potentially any linguistic investigation into bilinguals, represents a rather major limitation. It was perhaps a result of the complexity of quantifying language contact which caused the contact variables in Experiment II to lack significance. Considering the quantification procedure used in Experiment II, a general criticism is that it ran the risk of simplifying actual language contact. One could argue, for example, that there are uncountable ways in which a bilingual migrant (or for that matter any bilingual) may maintain contact with either or both of his or her languages. Although a number of these are documented in the Appendix, as stated above, they were not incorporated into the quantification process, and, even if they had been, they in turn would not complete the ways in which a bilingual migrant may maintain language contact. In essence, this argument boils down to the idea that more information is better. Since completing my interviews, I have come to the opposite conclusion that, when it comes to language contact, less information may be better.

A main reason for this interpretation is that language contact is a personal issue. This problem was naively first realised once the language background questionnaire had already been implemented. Questions such as “How often do you speak German with your partner?” presume that the participant, first of all, has a partner, and second of all that the participant speaks with his or her partner. Both of these cannot be assumed. Such sensitive issues and the general idea that so much personal information should be divulged from an individual often crossed the line of appropriateness. Talking about the exposure

a participant may have with his or her languages, at all, can be an emotional experience. Some participants in Experiment II had lost a partner recently (given the rather late age at recording). For future studies, the same naive assumption, that it is appropriate to ask as many questions as possible in order to gather as much information as possible, should not be made.

Such emotional issues make measuring language contact problematic. Not measuring them at all, or perhaps only very general language contact variables, is in fact a feasible alternative. This does not mean that such facets of language contact do not play a role in language proficiency, simply that they cannot, in practicality, be accounted for. The question therefore becomes whether documenting language contact in detail actually has any benefits. Is more detailed information really better, or, in the end, could a global self-assessment on the part of the participant be just as valuable? Although this was not a goal of the present study, I predict that the disadvantages of minute data collection regarding language contact outweigh any disadvantages that such a self-assessment may incorporate. Again, the question is: does more detailed data assessment give a researcher more reliable information? In an extreme detail-rich case, an alternative technique in the assessment of language contact is to observe conversations that bilinguals have, or communication within the bilingual network, or community. By many researchers, this is looked at as the most sound, if exhaustive, technique. Bilingual migrants are best directly observed by the researcher, because this tells one more about language contact. However, this again encroaches on the borders of privacy, as does a detail-rich questionnaire. Is, what essentially amounts to, following bilinguals around with a check list, morally sound?

Moreover, and this is potentially the question which most interests sociolinguistics, does it give a researcher more information? It is not possible to assume that direct observation actually provides the researcher with more information regarding language contact. The false assumption is that what a researcher observes is also that which would occur when he or she was not there. Who can be sure that this is the case? Alternatively, in a rigorous questionnaire, all conceivable ways in which a bilingual may maintain contact with a language could be measured. Again - who is to say that the bilingual answers each question honestly and accurately, so that the information is reliable? There is no way for a researcher to know this and in trying to attain what is in fact the unattainable, one infringes on the privacy of the individual.

Finally, language contact is dynamic. It is not only determined by the nature of the setting in which a migrant finds him or herself, but to a large extent by decisions which are made by the individual over time. It is possible for a migrant to seek out settings in which contact, and potentially specific types of contact, are already established. A migrant may also be able to actively change the *type* of contact already established within a setting.

Quantifying such changes in contact over time represent a further complication in this process. The fact that an individual has, at least in part, control over the amount and type of contact he or she has with the language(s) of his or her environment supports an action-oriented developmental perspective (Brandtstädter, 1993), which in turn is compatible with a dynamic perspective of bilingualism across the lifespan (de Bot, 2007).

Future studies which aim at quantifying language contact may be more advantageous if the participant is allowed to globally assess language contact on his or her own.

7.5 Limitations and future directions

In addition to the just mentioned limitation regarding the quantification of contact, other concerns are presently addressed.

Arguably, given that a particular moment was measured in Experiment I and Experiment II, it is feasible that these moments were not representative of other, similar moments experienced by bilingual migrants. Perhaps repetitions of the investigation may have delivered different results. Moreover, it is feasible that a listener may have more time to assess and re-assess the interlocutor's accent. In other words, it is not always the case that a listener is confronted with an anonymous, short, speech sample. The present rather controlled experiment may be less representative of a more holistic communication which occurs in "normal" communication. Generalising from the results is therefore potentially speculative, although the problems associated with re-testing bring other complications, i.e. re-training an element of speech which is, in fact, undergoing attrition.

Another limitation of this study draws upon the actual participants. During the recruitment process, the general impression from the participants who in the end volunteered their time, was that they felt in one way or another rather affiliated to their German culture and language. Other participants, some of whom finally chose to not take part made the impression of, more precisely, being reluctant to take part in a study which focused upon their country of origin. The people who finally showed up on the day of the recording were, it is my impression, those who don't mind, and perhaps even enjoyed, conversing in German and talking about their German background, not people who *in no way* identified with their German past and instead had quite fully taken on an English Canadian identity. Nevertheless, such individuals seemed to exist, as detected from the recruitment process.

Although this issue may seem rather superficial, I predict that it poses a complication for studies into first language attrition. Individuals who have no interest in their country of origin may be more likely to exhibit first language attrition, but researchers will

presumably have greater difficulty recruiting such migrants. In terms of a limitation, this means that the participants of the present study may, in fact, be representative of a lower end of the effects of first language attrition in a migrant setting.

The permanency of the loss, or the level of competence, has already been discussed. It is mentioned here again as the fact that an underlying competence in the bilinguals was not assessed is arguably a limitation of the research, although methodology in permeating the level of competence is, to say the least, scarce. This essentially means that although lack of information regarding the competence of loss does not devalue the loss of control at the level of performance, as revealed in the late consecutive bilinguals of the present study, one may still assert that in the present study competence should also have been measured. Future studies into first language attrition may wish to address this issue.

7.6 Conclusion

The findings from the study revealed that a native language can undergo first language attrition in the domain of phonetics. At the level of perception and performance, deviations from a monolingual native speaker norm were observed in the native speech of migrants who acquired a second language after moving abroad in late adolescence or adulthood.

In Experiment I, bilingual migrants were more likely to be perceived as non-native speakers of their native language than non-migrants. The group analyses of Experiment II indicated that in the German of the late consecutive bilinguals, the F1 frequency of the lateral phoneme /l/ was significantly higher, and the alignment of the start of the prenuclear rise significantly earlier, than in the German control group.

Interpersonal variation was also revealed. In Experiment I, 14 of the 57 bilingual migrants were perceived to be non-native speakers of their native language, whilst 20 evidenced no first language attrition in the perception of their native language. In Experiment II, two of the ten bilinguals evidenced no deviations from the monolingual norms of the selected phonetic elements. In contrast, one bilingual displayed first language attrition in all dimensions of both the lateral phoneme /l/ and prenuclear tonal alignment.

When predictor variables were examined, age of arrival proved to have the most significant impact in determining first language attrition. Individuals who migrated at an earlier age were more likely to undergo first language attrition both with regard to the perception of foreign accent in their native speech (Experiment I) as well with regard to prosody (Experiment II). Amount and type of language contact were significant predictor variables in the former but not in the latter experiment.

In the fine phonetic analyses of Experiment II, intrapersonal variation was also de-

tected. The F1 frequency of the lateral phoneme /l/ was more likely to display first language attrition than the F2 frequency; and the alignment of the start of the prenuclear rise more likely to evidence attrition than the end of the rise. Overall, it appeared that the F1 frequency of the lateral phoneme /l/ was most likely to show first language attrition, it being within the monolingual English norm for eight of the ten participants in their native German speech. In part, this suggests that the segmental level of speech may be more likely to evidence first language attrition than the prosodic, although because the frequency of F2 in the lateral phoneme /l/ showed a high degree of stability, this claim is premature. Moreover, merging effects between the L1 and the L2 of the phonetic elements were only verified with regard to the alignment of the start of the prenuclear rise.

In sum, the findings revealed that first language attrition in the domain of phonetics at the level of perception and performance coincided with a high degree of intra- and interpersonal variation. Future studies may concentrate on the personal impact of these findings. How is first language attrition experienced by bilingual migrants? What are the consequences of first language attrition in terms of a growing migrant population worldwide? As a first step in examining these questions, I argue that a more inclusive definition of native speech is called for, incorporating the L1 speech of bilingual migrants and likewise the L2 speech of highly proficient second language learners.

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Appendix A

Selected answers from Experiment II

Participant	Place of birth
1ExBG	Riesenburg, Westpreußen
2ExCL	Wolfsburg, Niedersachsen
3ExDZ	Hannover
4ExFS	Diestedde, NRW
5ExGB	Altena, Westfalen
6ExIKH	Hamburg
7ExID	Jettingen, Schwaben
8ExMZ	Bensheim an der Bergstraße
9ExMB	Lübeck, Schleswig-Holstein
10ExRMW	Frankfurt am Main, Hessen

Table A.1: Place of birth of the bilingual migrants

Participant	Place of birth
1CGH	Lodz
2CSS	Cologne
3CHD	Hohenelbe, Czech Republic
4CHWS	Frankpol (ehemalige Warthegau, auf der Flucht geboren)
5CSB	Hohenlimburg, NRW
6CDM	Erkrath, NRW
7CLH	Horrheim, Baden-Wrtenberg
8CHH	Riga
9CES	Galderbaum, Kreis Bielefeld, NRW
10CEL	Bornich, Germany
1CCDH	Section 23, Range 14, Township 12, Saskatchewan
2CCCZG	Terrace, BC, Canada
3CCBH	Detroit Michigan
4CCVEC	Vancouver, Canada
5CCJS	Riverport, NS
6CCBC	Imperial, Saskatchewan
7CCFS	Edmonton, Alberta
8CCLMS	Oxbow, Saskatchewan
9CCEJ	Pincher Creek, Alberta
10CCLK	Alliston, Ontario

Table A.2: Place of birth of the control groups

Participant	Places
1ExBG	Reisenburg (Prabuty), Westpreußen (0-4); Weisswasser, Schlesien (4-6); Eichenbck-Warthegau (5-11); Soltau, Hann (11-16)
2ExCL	Fallersleben, Niedersachsen (0-19)
3ExDZ	Hannover, Hamburg (0-3); Berlin (3-24)
4ExFS	Diestedde, NRW (0-1); Dortmund (1-21)
5ExGB	Altena, Westfahlen (0-20), Recklinghausen, Westfahlen (20-21); Stuttgart (21-22); South Africa (22-24); Berlin (25-27); various Africa (27-29); various Germany (29-32)
6ExIKH	Hamburg (0-27)
7ExID	Jettingen, Swabia (0-14); Tenniken, Baselland (14-20)
8ExMZ	Bensheim an der Bergstraße (0-6); Berlin (6-24); Heidelberg area (24-32)
9ExMB	Lübeck, Schleswig-Holstein (0-6); Luxhaven, Niedersachsen (6-11); Bremen (11-17)
10ExRMW	Frankfurt am Main area, Hessen (0-23)

Table A.3: Places where the bilingual migrants group grew up

Participant	Places
1CGH	Lodz, Poland (0-10); Potsdam (11-15); Hannover (15-18); Bonn (18-29); Cologne (29-present)
2CSS	Cologne (0-25); Trier (25-27); Cologne, (27-present)
3CHD	Berlin (0-present)
4CHWS	Münster (0-18); Berlin (18-19); Münster (20-21); Dortmund (21-22); Cologne (22-present)
5CSB	Schöningen, Niedersachsen (0-12); Neustadt, Schleswig Holstein (12-19); Berlin (19-present)
6CDM	Erkrath, NRW (0-20); Cologne (20-present)
7CLH	Horrheim, Baden-Württemberg (0-42); Vaihingen-Enz and Stuttgart (42-present)
8CHH	Riga (0-2); Lodz, Poland (2-6); Altdöbern, Brandenburg (6-16); Berlin (17-present)
9CES	Bielefeld (0-4); Heimstadt Niedersachsen (4-10); Bielefeld area (10-16), Düsseldorf, (16-20); Cologne (20-present)
10CEL	Bornich, Wiesbaden area (0-present)
1CCDH	Bromhead, Saskatchewan (0-4); Midale and Saskatoon, Saskatchewan (3-4 and 11-14); a lot of moving around in Anglophone Canada; Vancouver (20-35); Victoria, B.C. (35-45); Terrace, B.C. (49-present)
2CCCZG	Terrace, B.C. (0-19); Vancouver, B.C. (19-present)
3CCBH	Detroit, U.S. (0-10); Italy (10-12); California, New Jersey (12-29); various in B.C. (29-present)
4CCVEC	Vancouver (0-23); various England (23-27); Vancouver (28-31); Terrace, B.C. (31-present)
5CCJS	Riverport, NS (0-20); Saskatoon, Saskatchewan (20-29); Edmonton, Alberta (30-39); Terrace, B.C. (39-present)
6CCBC	Liberty, Saskatchewan (0-8), various B.C. (8-13); Terrace, B.C. (13-present)
7CCFS	Edmonton (0-5); Vancouver (5-25); Terrace, B.C. (25-present)
8CCLMS	Oxbow, Saskatchewan (0-6); Steinback, Manitoba (6-14); Winnipeg, Manitoba (14-26); Langly, B.C. (26-27); Vancouver (26-39); Terrace, B.C. (39-present)
9CCEJ	Pincher Creek, Alberta (0-7); various B.C. (7-12); Terrace, B.C. (12-present)
10CCLK	Hazelton, B.C. (0-8); Terrace, B.C. (8-present)

Table A.4: Places where the control participants grew up

	I. How strong? (0=none; 1=a little; 2=a lot)	II. Which regional accent?	III. Why?
1ExBG	0	<i>Pfälzer</i>	From father's side.
2ExCL	0	n.a.	n.a.
3ExDZ	1	<i>Berlinerisch</i>	<i>Grundschule</i> and <i>Volksschule</i> here.
4ExFS	0	n.a.	n.a.
5ExGB	1	<i>Sauerländisch, Westpfälisch</i>	Grew up in this area.
6ExIKH	1	Slight Hamburg accent	Grew up in Hamburg.
7ExID	1	<i>Schwäbisch</i> and <i>Schweizerisch</i>	Grew up in Swabia with Swiss mother.
8ExMZ	2	<i>Hessisch, Berlinerisch</i>	Lived in <i>Hessen</i> and Berlin.
9ExMB	1	<i>Norddeutsch</i>	Grew up in this area.
10ExRMW	1	<i>Hessisch</i>	Grew up in Frankfurt.

Table A.5: Regional accents of the migrants during their youth. The exact questions posed were: I. How strong was your German influenced by a regional accent during your youth? II. Which regional accent was this? III. Why did you name this regional accent?

	How strong? (0=none; 1=a little; 2=a lot)	Which regional accent?	Why?
1ExBG	0	n.a.	n.a.
2ExCL	0	n.a.	n.a.
3ExDZ	0	n.a.	n.a.
4ExFS	0	n.a.	n.a.
5ExGB	0	n.a.	n.a.
6ExIKH	0	n.a.	n.a.
7ExID	1	Schwäbisch and Schweizerisch	She grew up in Swabia, Swiss mother.
8ExMZ	0	n.a.	n.a.
9ExMB	1	Norddeutscher Akzent	She grew up here.
10ExRMW	1	Frankfurterisch, Hessisch	Grew up in Frankfurt.

Table A.6: Present regional accent of the bilingual participants. The exact questions posed were: I. How strong is your German influenced by a regional accent now? II. Which regional accent is this? III. Why did you name this regional accent?

	I. How strong? (0=none; 1=a little; 2=a lot)	II. Which regional accent?	III. Why?
1CGH	2	<i>Lodzerdeutsch</i>	He lived there.
2CSS	0	n.a.	n.a.
3CHD	1	<i>Berlinerisch</i>	He grew up there.
4CHWS	0	n.a.	n.a.
5CSB	0	n.a.	n.a.
6CDM	0	n.a.	n.a.
7CLH	1	Horrheim dialect	She grew up there, and mother from Stuttgart.
8CHH	1	Brandenburg and Baltic German, parents spoke High German at home.	Exposed to these dialects through family and play-mates.
9CES	0	n.a.	n.a.
10CEL	2	Bornich, <i>Hessen</i> dialect.	She grew up here.
1CCDH	1	American English	Town where he lived was close to the US border.
2CCCZG	0	n.a.	n.a.
3CCBH	1	New Jersey	He lived here for three years.
4CCVEC	0	n.a.	n.a.
5CCJS	1	Luneberg dutchmen, from N.S.	She grew up here.
6CCBC	1	Saskatchewan accent	She lived here in childhood.
7CCFS	0	n.a.	n.a.
8CCLMS	0	n.a.	n.a.
9CCEJ	0	n.a.	n.a.
10CCLK	0	n.a.	n.a.

Table A.7: Regional accents of monolinguals during their youth. The exact questions were: I. How strong was your German influenced by a regional accent during your youth? II. Which regional accent was this? III. Why did you name this regional accent?

	How strong? (0=none; 1=a little; 2=a lot)	Which regional accent?	Why?
1CGH	0	n.a.	n.a.
2CSS	0	n.a.	n.a.
3CHD	0	n.a.	n.a.
4CHWS	0	n.a.	n.a.
5CSB	0	n.a.	n.a.
6CDM	0	n.a.	n.a.
7CLH	1	Stuttgart and Horrheim dialect	She lives here.
8CHH	1	Baltic German and <i>Berlinerisch</i> .	Exposed to these dialects through parents and friends.
9CES	0	n.a.	n.a.
10CEL	1	Bornich, Hessen.	She grew up here, now friends with people from other areas.
1CCDH	0	n.a.	n.a.
2CCCZG	0	n.a.	n.a.
3CCBH	1	U.S.	Canadians say that they sometimes notice it.
4CCVEC	0	n.a.	n.a.
5CCJS	1	Luneberg dutchmen, from N.S.	People say that they sometimes here something when she speaks.
6CCBC	0	n.a.	n.a.
7CCFS	0	n.a.	n.a.
8CCLMS	0	n.a.	n.a.
9CCEJ	0	n.a.	n.a.
10CCLK	0	n.a.	n.a.

Table A.8: Present regional accent of monolinguals. The exact questions posed were: I. How strong is your German influenced by a regional accent now? II. Which regional accent is this? III. Why did you name this regional accent?

	1ExBG	2ExCL	3ExDZ	4ExFS	5ExGB	6ExIKH	7ExID	8ExMZ	9ExMB	10ExRMW
German										
Partner	0.00	0.00	0.75	0.13	0.75	0.00	0.75	1.00	0.38	
Children	0.25		0.50	0.00	0.25		0.13	0.50	0.38	
Grandchildren	0.00		0.25	0.00			0.00	0.25		
My relatives	0.75	1.00	0.75	1.00	1.00	1.00	1.00		1.00	0.38
Partner's relatives	0.00	0.00	1.00	0.00	1.00	0.00	0.75	1.00	1.00	
Friends in Canada	0.50	0.50	0.50	0.50	0.50	0.00	0.75	0.25	0.25	0.00
Friends in Germany	1.00	1.00	1.00	1.00	1.00	0.50	1.00	1.00	1.00	1.00
Co-workers in Canada	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.25
Co-workers in Germany							1.00		1.00	0.50
German total	0.313	0.417	0.679	0.375	0.643	0.250	0.597	0.571	0.625	0.425
German total normalised	0.269	0.356	0.657	0.354	0.593	0.250	0.394	0.539	0.504	0.426
English										
Partner	1.00	1.00	0.50	1.00	0.75	1.00	0.75	0.25	0.88	
Children	0.75		0.50	1.00	0.75		1.00	0.50	0.88	
Grandchildren	1.00		0.75	1.00			1.00	0.88		
My relatives	0.75	0.25	0.25	0.00	0.00	0.00	0.25		0.38	0.50
Partner's relatives	1.00	1.00	0.00	1.00	0.00	1.00	0.25	0.00	0.00	
Friends in Canada	0.75	1.00	0.50	0.88	0.75	1.00	0.50	0.75	1.00	1.00
Friends in Germany	0.00	0.00	0.00	0.00	0.00	0.50		0.00	0.00	0.00
Co-workers in Canada	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00
Co-workers in Germany				0.00				0.00		0.50
English total normalised	0.781	0.708	0.438	0.653	0.464	0.708	0.679	0.422	0.589	0.600
English total adjusted	0.731	0.644	0.343	0.646	0.407	0.750	0.606	0.461	0.496	0.574

Table A.9: Amount of contact with German and English

	1ExBG	2ExCL	3ExDZ	4ExFS	5ExGB	6ExIKH	7ExID	8ExMZ	9ExMB	10ExRMW
German										
Partner	0.00	0.00	0.50	0.25	0.50	0.00	0.50	0.00	0.75	
Children	0.50		1.00	0.00	0.50		0.25	1.00	0.75	
Grandchildren	0.00		0.50	0.00			0.00	0.50		
My relatives	0.50	0.00	0.50	0.00	0.00	0.00	0.00		0.00	0.25
Partner's relatives	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	
Friends in Canada	1.00	1.00	1.00	1.00	1.00	0.00	0.50	0.50	0.50	0.00
Friends in Germany	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Co-workers in Canada										0.50
Co-workers in Germany	0.00	0.00			0.00	0.00	0.00	0.00	0.00	1.00
German mixing total	0.250	0.167	0.500	0.179	0.286	0.167	0.194	0.286	0.250	0.350
English										
Partner	0.00	0.00	1.00	0.00	0.50	0.00	0.50	0.50	0.25	
Children	0.50		1.00	0.00	0.50		0.00	1.00	0.25	
Grandchildren	0.00		0.50	0.00			0.00	0.25		
My relatives	0.50	0.50	0.50	0.00	0.00	0.00	0.50		0.75	0.00
Partner's relatives	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	
Friends in Canada	0.50	0.00	1.00	0.25	0.50	0.00	1.00	0.50	0.00	0.00
Friends in Germany	0.00	0.00	0.00	0.00	0.00	1.00		0.00	0.00	0.00
Co-workers in Canada										0.00
Co-workers in Germany	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	1.00
English mixing total	0.188	0.083	0.500	0.028	0.214	0.250	0.357	0.281	0.179	0.200

Table A.10: Amount of language mixing in German and English

Appendix B

Word lists for lateral analysis

B.1 German word list

Words in bold were those used in the lateral analysis.

Part I Practice Words

1 Köln 2 heiß 3 Deutsch 4 schön 5 zwar 6 doch 7 Hans 8 Blech 9 Staat 10 gern 11 Quark
12 Glanz 13 fünf 14 Lenz 15 Wurst 16 Fleiß 17 Platz 18 wohl

Part I

19 Harz 20 Kohl 21 ganz 22 stößt 23 Lauch 24 Reis 25 schrill 26 Stift 27 Rülps 28 Till
29 Reh 30 Schwell 31 auch 32 grell 33 Fell 34 süß 35 Rang 36 grell 37 reif 38 Wein 39
Hund 40 grell 41 früh 42 Grill 43 Rhein 44 riech 45 Lärm 46 Rum 47 **viel** 48 Rost 49
Stiel 50 Geld 51 Schwell 52 Riff 53 Tee 54 Hecht 55 rein 56 Hund 57 Rum 58 Stuhl 59
rief 60 Strauß 61 Reim 62 Brief 63 ran 64 Drill 65 roch 66 Schwell 67 Stift 68 Wein 69
hell 70 ran 71 Riff 72 **viel** 73 Rest 74 Bach 75 Tee 76 **Hehl** 77 **Kiel** 78 Ruf 79 **Nil** 80 bell
81 **Kehl** 82 Kraut 83 Till 84 Speck 85 Dill 86 bell 87 Tee 88 prägt 89 Rang 90 Lärm 91
Ziel 92 längst 93 **viel** 94 Hof 95 gell 96 Rock 97 Lärm

Break

Part II Practice Words

98 Burg 99 fällt 100 Mainz 101 Laub 102 Maul 103 Sumpf

Part II

104 früh 105 Strauß 106 Harz 107 Kraut 108 Speck 109 Till 110 Stein 111 roch 112 **Siel**
113 süß 114 Tell 115 Kohl 116 hell 117 **Spiel** 118 Brief 119 Reis 120 hell 121 Ross 122
Hund 123 Bach 124 Reiz 125 **Priel** 126 Hecht 127 Krill 128 prägt 129 Tell 130 stößt 131
Fell 132 auch 133 Reim 134 ganz 135 Rest 136 Drill 137 rein 139 rief 140 Lauch 141
still 142 Rock 143 schrill 144 Spill 145 Rhein 146 **Stiel** 147 Ring 148 auch 149 Rest 150

Kehl 151 Rang 152 roch 153 Riet 154 Rum 155 Reiz 156 Geld 157 Sohn 158 **Fehl** 159 rief 160 ran 161 Rost 162 Stein 163 **Spiel** 164 Krill 165 gell 166 riech 167 Rost 168 Reiz 169 Ruf 170 längst 171 Ross 172 reit 173 Reis 174 Stift 175 Ross 176 still 177 Riss 178 Stein 179 reich 180 Hof 181 Ruf 182 Geld 183 Reh 184 gell

Break

Part III Practice Words

185 Pfalz 186 gar 187 Senf 188 Kölsch 189 dem 190 Zweig

Part III

191 Lauch 192 ganz 193 Kohl 194 Speck 195 Hof 196 Rock 197 Riet 198 Grill 199 **Kehl** 200 **Stiel** 201 Spill 202 **Ziel** 203 Reim 204 **Ziel** 205 Rülps 206 Grill 207 prägt 208 Spill 209 **Nil** 210 früh 211 still 212 Wein 213 reich 214 Dill 215 Riet 216 Krill 217 Drill 218 Bach 219 **Hehl** 220 Ring 221 reit 222 Dill 223 bell 224 stöt 225 reit 226 Rülps 227 **Hehl** 228 schnell 229 reich 230 will 231 Stuhl 232 **Priel** 233 schnell 234 Sohn 235 **Spiel** 236 Rhein 237 süß 238 Ring 239 **Kiel** 240 Strauß 241 rein 242 Kraut 243 will 244 **Kiel** 245 **Siel** 246 schnell 247 reif 248 Tell 249 Brief 250 Fell 251 Riss 252 längst 253 reif 254 Reh 255 **Fehl** 256 **Nil** 257 Stuhl 258 Riss 259 schrill 260 **Priel** 261 Harz 262 **Siel** 263 Hecht 264 Sohn 265 riech 266 Riff 267 **Fehl** 268 will

B.2 English word list

Words in bold were those used in the lateral analysis.

Part I Practice Words

1 Smith 2 Bill 3 joke 4 Steve 5 guy 6 though 7 Jim 8 hike 9 puck 10 fries 11 should 12 chips 13 car 14 fence 15 Lee 16 Jill 17 logs 18 dump

Part I

19 thus 20 Sue 21 bird 22 juice 23 bruise 24 **heal** 25 rights 26 **eel** 27 tell 28 ride 29 pub 30 bell 31 reach 32 reef 33 squid 34 krill 35 quick 36 fright 37 **spiel** 38 well 39 writes 40 **eel** 41 ray 42 talk 43 still 44 rich 45 guard 46 reach 47 **mail** 48 read 49 ill 50 drill 51 map 52 pig 53 krill 54 **veal** 55 dill 56 **real** 57 **heel** 58 sight 59 kill 60 as 61 hill 62 **steal** 63 **real** 64 James 65 reed 66 mill 67 reap 68 sleep 69 thin 70 **male** 71 tap 72 ring 73 **kale** 74 chick 75 **jail** 76 rug 77 drill 78 sky 79 will 80 rust 81 rock 82 **mail** 83 fill 84 show 85 reach 86 rock 87 **veal** 88 reef 89 square 90 **eel** 91 swell 92 chair 93 **sail** 94 rest 95 **teal** 96 **bale** 97 rag 98 fill 99 rice 100 **teal** 101 moose 102 **kale** 103 ran 104 **peal** 105 sell 106 tell 107 smell 108 ribs 109 rights 110 **heal** 111 mill 112 shrug 113 ran 114 **meal** 115 reap 116 watch 117 rock 118 grill 119 nick 120 kill 121 rang 122 **nail** 123 **heel** 124 **real**

Break

Part II Practice Words

125 peas 126 would 127 love 128 roast 129 like 130 Jake

Part II

131 quick 132 map 133 talk 134 shrug 135 chair 136 grill 137 hill 138 rich 139 cheese 140 ride 141 squid 142 still 143 ring 144 bird 145 **fail** 146 ribs 147 cheese 148 **spiel** 149 till 150 **fail** 151 read 152 **feel** 153 rights 154 yell 155 ray 156 juice 157 reef 158 rust 159 bill 160 rhyme 161 **steal** 162 writes 163 sight 164 rest 165 **tail** 166 Sue 167 ran 168 fright 169 **male** 170 **zeal** 171 till 172 pub 173 ripe 174 **kale** 175 reed 176 pub 177 will 178 **steal** 179 rag 180 as 181 **feel** 182 ripe 183 fell 184 guard 185 mill 186 bruise 187 smell 188 **deal** 189 **gale** 190 red 191 watch 192 **peal** 193 **mail** 194 nick 195 **fail** 196 drill 197 tap 198 swell 199 rich 200 thus 201 **seal** 202 moose 203 **kneel** 204 ring 205 sell 206 **rail** 207 will 208 rice 209 well 210 square 211 ill 212 James 213 **spiel** 214 **heal** 215 shrill 216 still 217 pill 218 swell 219 tell 220 cheese 221 thin 222 rice 223 pill 224 chick 225 **tail** 226 pig 227 **jail** 228 roof 229 **bale** 230 show 231 thin 232 rhyme 233 ill 234 sky 235 **heel** 236 **meal**

Break

Part III Practice Words

237 pie 238 could 239 gran 240 lawn 241 bowl 242 queen

Part III

243 chair 244 as 245 talk 246 sight 247 thus 248 rest 249 **jail** 250 pill 251 pig 252 fill
253 **rail** 254 map 255 **deal** 256 rag 257 hill 258 bird 259 **nail** 260 writes 261 dill 262 tap
263 **feel** 264 read 265 bell 266 till 267 guard 268 krill 269 **deal** 270 shrill 271 sleep 272
peal 273 rang 274 **wheel** 275 ribs 276 moose 277 reed 278 **whale** 279 **sail** 280 bill 281
tail 282 James 283 **zeal** 284 rust 285 bill 286 ride 287 **whale** 288 **veal** 289 **rail** 290 rug
291 grill 292 squid 293 shrill 294 rhyme 295 shrug 296 smell 297 dill 298 **teal** 299 rug
300 **whale** 301 ripe 302 **bale** 303 reap 304 **meal** 305 kill 306 rang 307 bell 308 **kneel** 309
seal 310 fright 311 rum 312 sell 313 **wheel** 314 bruise 315 sleep 316 **vale** 317 chick 318
ray 319 well 320 roof 321 **seal** 322 red 323 **sail** 324 sky 325 yell 326 rum 327 **kneel** 328
vale 329 Sue 330 red 331 **wheel** 332 roof 333 fell 334 watch 335 **gale** 336 square 337
rum 338 yell 339 quick 340 **vale** 341 juice 342 **nail** 343 **male** 344 fell 345 show 346 **gale**
347 nick 348 **zeal**

Appendix C

Sentences for tonal alignment analysis

C.1 German sentences

Syllables in bold were those used in the tonal alignment analysis.

Practice run:

Die Kö in Düsseldorf ist eine Edelstraße.
Machst du dieses Jahr an der Nordsee Urlaub?
Es gibt viele Burgen und Schlösser am Rhein.

Sentences after the practice run:

In Trier und Nürnberg gibt es einen tollen Weihnachtsmarkt.
Toll, dass er auch mitkommt!
Die Verlängerung der Ausleihfrist ist leider nicht möglich.
Sind die Alpen nun schon mit Schnee bedeckt?
Von dir hört man ja dolle Sachen!
Der Dresdner Stollen schmeckt mir besonders gut.
Der Schnee lässt mich vor Freude bis an die Decke springen.
Die Ernennung Meiers zum Minister wurde nicht von allen Parteimitgliedern begrüßt.
Im Schwarzwald grassiert zur Zeit die Tollwut.
In Ermangelung eines Lehrers übernahm ein Student den Unterricht.
Wieviel Toleranz hast du dafür?
Die Lungentätigkeit des Patienten mußte künstlich aufrecht erhalten werden.
Seine mangelhaften Leistungen erlaubten es ihm nicht vorzurücken.

Der Schwarzwald hat mehr zu bieten als nur Kirschtorten.

Die **n**onnenhafte Kleidung steht ihr überhaupt nicht.

Gehen ihre Kinder regelmäßig zur Kirche?

Auf **V**erlangen von Herrn Müller haben wir unser Sortiment erweitert.

Das älteste Lebkuchenrezept wird in Nürnberg aufbewahrt.

Ein nennenswerter Unterschied war nicht auszumachen.

Die Kirschbäume in voller Blüte sehen toll aus.

Münster ist eine tolle Stadt zum Rad fahren.

Die **m**ollige Dame bezauberte durch ihr Lächeln.

Die Ostsee ist ein tolles Segelrevier.

Die **M**innesänger von Nürnberg waren sehr berühmt.

Sollen wir die Stuckdecke renovieren?

Bei **L**ängengrad Null wird die Universalzeit bestimmt.

Wer deckt bei euch den Tisch?

C.2 English sentences

Syllables in bold were those used in the tonal alignment analysis.

Practice run:

Robson Street is expensive.

You can ski at Whistler.

He likes ethnic food.

Sentences after the practice run:

He was madder than a raging bull.

When we arrived, the party was in full swing.

There was a **nominal** fee for his services.

She was just joking with the taxi driver.

Could the matter be dealt with quietly?

There is a **phenomenal** interest in the products.

Could it be true?

She got a **unanimous** vote for the proposal.

Richmond is growing quickly.

What does that matter to you?

They got an **anonymous** call from a witness.

My children are at UBC.

He made a **lemony** sorbet for dessert that evening.

Could you turn on the CBC news please?

Shes a **ministers** wife in the Home Counties.

I couldnt be bothered to take the bus in the rain.

Do you think this is a joking matter?

There were **monogrammed** sheets in the hotel rooms.

The Coastal Mountains got more snow this year.

Dont you think he should be behind bars?

There is a **minuscule** chance of surviving a plane crash.

Do you have anything planned for New Years?

I need a **monosyllabic** word for my crossword puzzle.

BC Ferries has become less reliable.

Children should be seen and not heard.

They sentenced the **millitant** splinter group to five years.

Nanaimo bars come from the same city.

Did matter originate from the Big Bang?

You need a **mineral** and vitamin supplement to get well.

Have you ever tried Native Canadian food?

They charge a **minimum** rate for the use of their phone lines.

The bar on the Alaskan cruise ship is amazing.

He took a **mineral** enriched supplement every morning.

Do you want to go for a walk along the Sea Wall?

They showed a **minimal** interest in what he had to say.

Have you ever fished that bar on the Fraser?

Appendix D

Stories for pitch range analysis

D.1 German story

Ich rauchte gerade vor der Schule als ich Ben sah. Das bedeutet normalerweise Ärger. Er ist ziemlich zerstreut. Er kam herüber zu mir und unterhielt sich mit mir.

Er begann: "Mir fällt der schnellste Weg von hier zum Zoo nicht ein. Weißt du, ehrlich gesagt, glaube ich, dass ich mich verlaufen habe."

"Tja, geh bei der Kneipe los", sagte ich.

"Welche Kneipe?", fragte Ben.

"Die Alte Linde", antwortete ich.

Er fragte, wo die denn sei. Ich sagte ihm, sie sei in der Nähe des Goldenen Hahns.

"Nein, nein, das ist drüben zwischen dem Schwimmbad und dem Anglergeschäft", sagte Ben.

Ich sagte: "Ist das nicht die Berliner Bar? Warte mal, ich glaube du hast recht. Tja, warum nicht über den Pfad am Fluss gehen?"

"Zu langsam", sagte er. "Wirklich, ich könnte einen Fahrer gebrauchen. Hast du ein Auto?"

Ich sagte ihm, ich hätte keines, aber der dreiunddreißiger Bus hielte in der Nähe. Hier gab er letztendlich auf und sagte er würde stattdessen zum Sportzentrum gehen, um Tennis zu spielen.

D.2 English story

I was smoking outside the school when I saw Ben. That usually means trouble. He's rather absent-minded. He came over to me so we talked.

He began, "I can't think what's the quickest way to the zoo from here. Actually you know, I reckon I'm lost."

"Well, start from the pub," I said.

"Which pub?" Ben asked.

"The Jolly Judge," I answered.

He asked where it was. I told him it was near the Bridge Inn.

"No, no, that's over there between the swimming pool and the fishing shop," Ben said.

I said, "Isn't that the Dog and Duck? Wait a minute, I think you're right. Well, why not go via the river path?"

"Too slow," he said. "Really, I could do with a lift. Have you got a car?"

I told him I hadn't, but the thirty-three bus went near there. At this he finally gave up and said he was off to the sports centre to play tennis instead.